(UN)CORPORATE CRYPTO-GOVERNANCE

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Public blockchain protocols face a serious governance crisis. Thus far, blockchain protocols have followed the path of early internet governance. If the architects of blockchain protocols are not careful, they may suffer a similar fate—increased governmental control, greater centralization, and decreased privacy. As blockchain architects begin to consider better governance structures, there is a legal movement underway to impose a fiduciary framework on open-source software developers. If the movement succeeds, the consequences for open-source software development could be dire. If arbitrarily imposed on blockchain communities without consideration of variances among communities or the reality of how such communities operate, the movement may quash the technology before it ever matures. Further, in its present iteration, the argument for imposing fiduciary duties is not limited to the blockchain context and could easily be extended to other open-source projects. Such open-source projects have not been subject to this fiduciary responsibility scheme and yet have been an important force in industry and society for decades. Instead, this Article argues that blockchain architects should consider adopting governance contracts that rely on corporate governance models for inspiration. Such a model would not obliterate the notion of fiduciary responsibilities in blockchain governance but rather would allocate such responsibility in light of the actual mechanics of the technology. The model also enables a scheme that heightens responsibility for more actors in the ecosystem under certain circumstances. Furthermore, contractually based governance systems offer blockchain protocols an opportunity to adopt governance rules that reflect the unique goals and culture of the protocols and their communities while

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appeasing the regulator's need for a legally recognizable and responsible hierarchy. Although there will be cultural challenges to governing blockchain protocols under a corporate law model, this Article not only concludes that navigating such challenges is possible but also offers an opportunity to encourage new corporate governance structures in more traditional enterprises.

INTRODUCTION

During the last four decades,[1] communities of open-source[2] software developers around the world have produced some of the most important

1. Siva Vaidhyanathan, *Open Source as Culture—Culture as Open Source*, *in* OPEN SOURCE JAHRBUCH 2005: ZWISCHEN SOFTWAREENTWICKLUNG UND GESELLSCHAFTSMODELL 359, 361 (Bernd Lutterbeck et al. eds., 2005) (tracing the beginning of the open-source software movement to Richard Stallman's work in the 1970s); *see also* David Bretthauer, *Open Source Software: A History*, INFO. TECH. & LIBR., Mar. 2002, at 3, 3 (tracing the beginning of the open-source software movement to Richard Stallman's work on GNU in the 1970s).

2. Although often used interchangeably, the terms "open-source software" and "free software" reflect very different meanings to the communities that use those terms. Open-source software generally refers to software that is available without an economic cost, while free software is used to describe software imbued with certain ideals. *See* Yochai Benkler, *Coase's Penguin, or, Linux and "The Nature of the Firm,"* 112 YALE L.J. 369, 371 n.2 (2002); Vaidhyanathan, *supra* note 1, at 359 n.1. Although many public blockchain protocols reflect libertarian values, it is impossible to say that every blockchain protocol does. Therefore, I adopt the term open-source software in this Article to broadly encompass any blockchain protocol that is made available under an open-source software license, irrespective of any political ideals the surrounding community holds.

technological advances in computing that society enjoys today.[3] Many such communities create this software with even less hierarchy than today's internet governance systems.[4] Although many commercial entities, including Facebook, profit from the advances made by open-source software developers, many of the contributors to open-source projects do not.[5] Instead, many open-source software developers contribute to a project for a variety of other, less tangible, motives, including career advancement, love of the work, the joy in solving a puzzle, or the desire to simply solve a problem that makes their lives as software users easier.[6] Whatever the motivations for their contributions, without open-source software development, everyday computer users would not enjoy the benefits of key computing software such as HTML,[7] Apache,[8] and Linux,[9] among others.

A relatively new open-source software project, the Bitcoin blockchain, once again demonstrates the power of open-source software innovation.[10] The Bitcoin blockchain,[11] which powers a peer-to-peer payment transaction

3. Vaidhyanathan, *supra* note 1, at 362 ("While Linux and the GNU (Free Software) project have garnered the most attention in accounts of Open Source development, the protocols and programs that enable and empower the e-mail, the World Wide Web, IRC, and just about every other activity on the Internet all emerged from community-based project teams, often ad-hoc and amateur.").

4. GEORGE DAFERMOS, GOVERNANCE STRUCTURES OF FREE/OPEN SOURCE SOFTWARE DEVELOPMENT 187 (2012).

5. *See, e.g.*, Benkler, *supra* note 2, at 372–73 ("Programmers do not generally participate in a[n] [open-source] project because someone who is their boss instructed them, though some do. They do not generally participate in a project because someone offers them a price, though some participants do focus on long-term appropriation through money-oriented activities, like consulting or service contracts. But the critical mass of participation in projects cannot be explained by the direct presence of a command, a price, or even a future monetary return, particularly in the all-important microlevel decisions regarding selection of projects to which participants contribute.").

6. *See generally* PEKKA HIMANEN, THE HACKER ETHIC AND THE SPIRIT OF THE INFORMATION AGE (2001); GLYN MOODY, REBEL CODE: THE INSIDE STORY OF LINUX AND THE OPEN SOURCE REVOLUTION (2001) (discussing how coding skills improve through peer review); Bengt Holmstrom, *Managerial Incentive Problems: A Dynamic Perspective*, 66 REV. ECON. STUD. 169 (1999) (discussing job-market signaling); Justin Pappas Johnson, *Open Source Software: Private Provision of a Public Good*, 11 J. ECON. & MGMT. STRATEGY 637 (2002); Josh Lerner & Jean Tirole, *Some Simple Economics of Open Source*, 50 J. INDUS. ECON. 197 (2002); Eric von Hippel, *Innovation by User Communities: Learning from Open Source Software*, 42 SLOAN MGMT. REV. 82 (2001) (discussing user needs).

7. *See generally* TIM BERNERS-LEE, WEAVING THE WEB: THE ORIGINAL DESIGN AND ULTIMATE DESTINY OF THE WORLD WIDE WEB BY ITS INVENTOR (1999) (detailing, among other things, the open-source development of HTML as spearheaded by Tim Berners-Lee).

8. *See generally* APACHE SOFTWARE FOUND., https://apache.org/index.html [https://perma.cc/29P6-5AFX] (last visited Mar. 17, 2020).

9. *See generally* Bretthauer, *supra* note 1, at 3 (detailing the history of Linux's open-source development).

10. *Get Started with Bitcoin*, BITCOIN PROJECT, https://bitcoin.org/en/ [https://perma.cc/2HDL-QG4A] (last visited Mar. 17, 2020) ("Bitcoin is open-source; its design is public, nobody owns or controls Bitcoin and everyone can take part.").

11. Generally speaking, the Bitcoin software, protocol, and network are referenced using the uppercase "Bitcoin" while the lowercase "bitcoin" refers to individual units of cryptocurrency. Angela Walch, *The Bitcoin Blockchain as Financial Market Infrastructure: A Consideration of Operational Risk*, 18 N.Y.U. J. LEGIS. & PUB. POL'Y 837, 846 n.41 (2015).

system, and other public blockchains[12] are software development projects deeply rooted in the open-source culture and governance ethos.[13] Blockchain communities often present a metanarrative of blockchain protocols as a "*libertarian dream* which aims at reducing the control of governments on the economy."[14] This narrative originates in the history of the "Cypherpunks," a group of cryptographers working in a multistakeholder, collaborative manner to produce technologically innovative tools allowing for regulation without sacrificing privacy.[15] According to the Cypherpunk manifesto, the group believed: "Privacy is necessary for an open society in the electronic age. . . . We cannot expect governments, corporations, or other large, faceless organizations to grant us privacy . . . . We must defend our own privacy if we expect to have any."[16] To defend privacy, the Cypherpunks believed that individuals needed the capability to send encrypted communications and to conduct anonymous financial transactions.[17] The Bitcoin blockchain emerged from efforts to create an anonymous transaction system, and the Cypherpunk culture of civil disobedience and libertarianism continues to echo through many of the various blockchain ecosystems and

12. Generally speaking, a blockchain is "a linked list that is built with hash-pointers instead of pointers." ARVIND NARAYANAN ET AL., BITCOIN AND CRYPTOCURRENCY TECHNOLOGIES: A COMPREHENSIVE INTRODUCTION 11 (2016). "So each block not only tells us where the value of the previous block was, but it also contains a digest of that value, which allows us to verify that the value hasn't been changed. We store the head of the list, which is just a regular hash-pointer that points to the most recent data block." *Id.* The "Bitcoin blockchain" refers specifically to the protocol of the native cryptocurrency bitcoin. When people refer to "the blockchain" or "The Blockchain," they often mean to refer to the Bitcoin blockchain. Otherwise, it is more appropriate to speak of blockchain technology, or a blockchain protocol, as there are many variants of the technology and a number of protocols in operation. A "protocol," for its part, is "a set of instructions for the compilation and interaction of objects." ALEXANDER R. GALLOWAY, PROTOCOL: HOW CONTROL EXISTS AFTER DECENTRALIZATION 75 (2004). Blockchains are a form of network protocols. Generally, a "network protocol" simply sets the rules that allow networked computers (nodes) to communicate with each other. Will Warren, *The Difference Between App Coins and Protocol Tokens*, MEDIUM: 0X BLOG (Feb. 2, 2017), https://blog.0xproject.com/the-difference-between-app-coins-and-protocol-tokens-7281a428348c [https://perma.cc/PA8N-NSTA]. For example, the Internet Protocol is a network protocol that defines the digital message formats and rules for communication among connected computers. *Internet Protocol (IP)*, TECHOPEDIA (Aug. 30, 2019), https://www.techopedia.com/definition/5366/internet-protocol-ip [https://perma.cc/ZNG7-9HJS]. Email is also built on a protocol that allows users to communicate with one another; "[i]t's just a way for two computers to talk to one another." Ryan Shea, *When to Use Protocol Tokens*, MEDIUM (Nov. 13, 2017), https://medium.com/@ryanshea/protocol-tokens-1ed44fa89453 [https://perma.cc/6HA5-BCWE].

13. HENNING DIEDRICH, ETHEREUM: BLOCKCHAINS, DIGITAL ASSETS, SMART CONTRACTS, DECENTRALISED AUTONOMOUS ORGANISATIONS 254 (2016) (explaining that the Bitcoin blockchain and other public blockchains have their roots in the Cypherpunk tradition).

14. *See* Primavera De Filippi & Benjamin Loveluck, *The Invisible Politics of Bitcoin: Governance Crisis of a Decentralised Infrastructure*, INTERNET POL'Y REV., Sept. 2016, at 1, 3.

15. DIEDRICH, *supra* note 13, at 254.

16. *Id.* at 255 (quoting Eric Hughes, *A Cypherpunk Manifesto*, ACTIVISM.NET (Mar. 9, 1993), https://activism.net/cypherpunk/manifesto.html [https://perma.cc/2Q9Y-VBFZ]).

17. *Id.* at 259.

their participants.[18] Blockchain technology is poised to follow in the footsteps of other earlier open-source projects by providing powerful benefits to society and the economy. By 2018, the leading public blockchains[19] powered around $20 billion in economic activity, or roughly 0.025 percent of the global gross domestic product.[20]

Despite its contributions to technological innovation and the economy, the open-source software development movement is currently under attack. An emerging line of legal literature suggests that open-source software developers should be subject to fiduciary law for the mere act of contributing code to an open project.[21] Lawsuits claim that open-source software developers owe users monetary damages because the developers did not make certain changes to the software that a particular group of users wanted.[22] At least one key contributor to the Ethereum blockchain ceased making contributions for fear of reprisal under the laws of his home jurisdiction.[23] Although those attacks currently focus on blockchain software development, the literature seems to pay little attention to the broader potential impact on open-source software development generally. In other words, a legal movement is afoot that purportedly seeks to punish individual blockchain developers for a broad swath of undefined behavior without considering the broader impact on, or the culture and context of, the open-source software movement. Because this proposal for regulating open-source developers already caused negative externalities that threaten the survival of open-source software projects, such as developers abandoning their work,[24] they are unlikely to be the optimal governance solution.[25]

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18. *Id.* at 259–60 (describing developments like Zcash and Ethereum as the next steps in the Cypherpunk vision for distributed ledger technology (DLT)).

19. Namely, the Bitcoin blockchain and the Ethereum protocol.

20. WORLD ECON. FORUM, DEEP SHIFT: TECHNOLOGY TIPPING POINTS AND SOCIETAL IMPACT 24 (2015), http://www3.weforum.org/docs/WEF_GAC15_Technological_Tipping_Points_report_2015.pdf [https://perma.cc/U4QG-VEV9]. The World Economic Forum predicts that 10 percent of global gross domestic product will be stored on blockchain technology by 2027. *Id.*

21. *See, e.g.*, Angela Walch, *In Code(rs) We Trust: Software Developers as Fiduciaries in Public Blockchains*, *in* REGULATING BLOCKCHAIN: TECHNO-SOCIAL AND LEGAL CHALLENGES 58 (Philipp Hacker et al. eds., 2019) [hereinafter Walch, *In Code(rs) We Trust*]; Angela Walch, *Call Blockchain Developers What They Are: Fiduciaries*, AM. BANKER (Aug. 9, 2016), https://www.americanbanker.com/opinion/call-blockchain-developers-what-they-are-fiduciaries [https://perma.cc/J5P3-ZS5U] [hereinafter Walch, *Call Blockchain Developers What They Are*].

22. Complaint at 3–4, Brola v. Nano, No. 1:18-cv-02049 (E.D.N.Y. Apr. 6, 2018). The complaint specifically alleges the failure of Nano's core development team to "rescue fork" the Nano protocol in support of users' claims for compensatory and equitable relief—including the return of funds lost at the BitGrail exchange. *Id.*

23. Rachel Rose O'Leary, *Ethereum Developer Resigns as Code Editor Citing Legal Concerns*, COINDESK (Feb. 15, 2018), https://www.coindesk.com/ethereum-developer-resigns-as-code-editor-citing-legal-concerns/ [https://perma.cc/7Q9E-G9X9].

24. *See id.*

25. Yochai Benkler made a similar point regarding property law and peer production, explaining that

> [r]egulators concerned with fostering innovation may better direct their efforts toward providing the institutional tools that would help thousands of people to

On the other hand, experts concur that many public blockchains face a governance crisis.[26] If public blockchain protocols cannot resolve this governance crisis, these governance failures may lead to blockchain architectures that produce the crypto equivalent of the Facebook–Cambridge Analytica privacy scandal.[27] Twenty years ago, Professor Lawrence Lessig predicted that this turn of events would occur unless greater consideration was given to the governance processes that presided over the architecture of the internet. Specifically, Professor Lessig warned:

> What if an architecture emerges that permits constant monitoring; an architecture that facilitates the constant tracking of behavior and movement. What if an architecture emerged that would costlessly collect data about individuals, about their behavior, about who they wanted to become. And what if the architecture could do that invisibly, without interfering with an individuals [sic] daily life at all?[28]

Arguably, society's collective failure to create better governance mechanisms for the internet and its applications resulted in the fulfillment of Lessig's dire predictions.[29]

To allow open-source blockchain projects to retain governance mechanisms endogenous to their unique cultures and visions and to protect open-source software development communities more broadly, this Article argues that blockchain communities should consider looking to corporate law

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> collaborate without appropriating their joint product, making the information they produce freely available rather than spending their efforts to increase the scope and sophistication of the mechanisms for private appropriation of this public good as they now do.

Benkler, *supra* note 2, at 446.

26. As discussed further below, two types of governance are relevant to blockchains: on-chain and off-chain governance. *See infra* notes 77–84 and accompanying text. On-chain governance refers to attempts to hard code governance rules into the consensus mechanism used to confirm transactions conducted on the protocol, while off-chain governance refers to the process that takes place outside of the code by which the software developers and blockchain validators propose, create, and implement updates, upgrades and other changes to the software. Wessel Reijers et al., *Now the Code Runs Itself: On-Chain and Off-Chain Governance of Blockchain Technologies*, TOPOI, Dec. 17, 2018, at 1, 2.

27. Phillip Tracy, *The Fallout from Facebook's Cambridge Analytica Data Crisis*, DAILY DOT (Mar. 27, 2018), https://www.dailydot.com/debug/facebook-cambridge-analytica-timeline/ [https://perma.cc/S73E-7T8L]. A blockchain protocol, then, is a network protocol that defines the rules that enable networked computers to exchange value on a peer-to-peer basis.

28. Lawrence Lessig, The Laws of Cyberspace 15 (Apr. 3, 1998) (unpublished manuscript), https://cyber.harvard.edu/works/lessig/laws_cyberspace.pdf [https://perma.cc/WC2B-VTLT].

29. *See generally* JACK GOLDSMITH & TIM WU, WHO CONTROLS THE INTERNET?: ILLUSIONS OF A BORDERLESS WORLD (2006); DAVID LYON, SURVEILLANCE STUDIES: AN OVERVIEW (2007); JONATHAN ZITTRAIN, THE FUTURE OF THE INTERNET AND HOW TO STOP IT (2009); Roger A. Clarke, *Information Technology and Dataveillance*, 31 COMM. ACM 498, 499 (1988) (describing "dataveillance" as "the systematic use of personal data systems in the investigation or monitoring of the actions or communications of one or more persons"); Margaret Hu, *Algorithmic Jim Crow*, 86 FORDHAM L. REV. 633 (2017) (describing the use of the widespread data available via internet connectivity to enforce a technologically driven Jim Crow regime).

for models of governance that will be respected by the law yet remain customizable. Specifically, participants in public blockchain systems[30] should contractually delineate governance mechanisms, modeling elements of corporate governance. This Article further argues that using corporate governance as inspiration for blockchain governance also provides important insight into corporate law.[31] Blockchain technology[32] proponents often herald the technology as a tool for disrupting the corporate sphere and further democratizing society; however, more functional similarities exist between blockchains and corporations than are often acknowledged. Indeed, proponents of the company in the nineteenth century argued for recognition of their innovation as an enabling technology.[33] The company might be viewed as a technology because it enables a uniquely effective method to ensure productive collaboration toward a collectively profitable end.[34] Blockchain technology does the same thing through computer code.

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30. The choice of the word "systems" is purposeful. I have repeatedly advocated for a comparative and systems analysis–based framework for analyzing the intersection of law, distributed ledger technology, and blockchain technology. Carla L. Reyes, *If Rockefeller Were a Coder*, 87 GEO. WASH. L. REV. 373, 390 (2019) [hereinafter Reyes, *Rockefeller*]; *see also* Carla L. Reyes, *Conceptualizing Cryptolaw*, 96 NEB. L. REV. 384, 391 (2017) [hereinafter Reyes, *Conceptualizing Cryptolaw*].

31. The nature of both comparative enterprise and systems analysis provide endogenous impetus for considering the inverse of each question related to substance, structure, and culture. Comparative law's core mission is reciprocal in nature. "The real aim of comparative law is to offer insight and perspective so that we are better equipped to reflect critically about ourselves and our own legal culture." Edward J. Eberle, *The Method and Role of Comparative Law*, 8 WASH. U. GLOBAL STUD. L. REV. 451, 471–72 (2009). Systems analysis, for its part, views a system as consisting of coordinated and interconnected elements that "operate as a unified whole to serve a given function or purpose." Tamara Belinfanti & Lynn Stout, *Contested Visions: The Value of Systems Theory for Corporate Law*, 166 U. PA. L. REV. 579, 599 (2018). Systems analysis recognizes that these interconnected elements influence each other even as they work together. *Id.* Furthermore, systems theory teaches that each system may be part of another, larger system. *Id.* Under these premises, at every intersection of law and blockchain technology exists the potential for a two-way impact exchange, wherein the law impacts blockchain and its code, while blockchain technology, its code, and the possibilities it enables may inversely offer lessons for the law. In the context of this Article, the implication, therefore, is that if corporate governance mechanisms offer lessons for blockchain governance, blockchain protocols may hold lessons for corporate law.

32. "In general, the term 'distributed ledger technology' refers to all initiatives and projects that are building systems to enable the shared control over the evolution of data without a central party, with individual systems referred to as 'distributed ledgers.' If one wants to describe a system that has global data diffusion and/or uses a data structure of chained blocks, one should call it a 'blockchain.'" GARRICK HILEMAN & MICHEL RAUCHS, GLOBAL BLOCKCHAIN BENCHMARKING STUDY 24 (2017), https://www.ey.com/Publication/vwLUAssets/ey-global-blockchain-benchmarking-study-2017/$FILE/ey-global-blockchain-benchmarking-study-2017.pdf [https://perma.cc/N9MC-Q422]. Generally speaking, in my work, I prefer to consider legal issues at the intersection of all the variants of DLT and blockchain technology. So I usually adopt the term DLT with the usual caveats. This Article, however, is specifically concerned with the governance of public, open-source blockchain protocols. Thus, this Article generally refers to "blockchain protocols." Nevertheless, the Article intends to capture the full range of those protocols, without regard to the consensus mechanism used (e.g., proof of work, proof of stake, etc.).

33. JOHN MICKLETHWAIT & ADRIAN WOOLDRIDGE, THE COMPANY: A SHORT HISTORY OF A REVOLUTIONARY IDEA, at xx (2003).

34. *Id.*

Blockchain protocols and their proponents reflect this reality without realizing it. For example, masternode protocols, in their efforts to create a governance structure enabling efficient decision-making, intuitively copy a partnership structure.[35] Other blockchain protocol architects explain their code by analogizing them to corporations.[36] In fact, some protocols, smart contracts, and "decentralized autonomous organizations" (DAOs) could be structured as business trusts that receive corporate treatment without actually incorporating.[37] Other protocol architects are exploring ways to formally incorporate their projects.[38] Regardless of whether protocol architects intend to organize a specific protocol as a legally recognized business entity or the comparison is more theoretical, the entire range of scenarios points to the broader potential of the corporate governance experience to shape blockchain protocol governance. Indeed, many open-source projects, including some blockchain ecosystems,[39] rely on various formal and informal governance mechanisms that include both formal incorporation and contractual governance.[40]

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35. *See, e.g.*, Mitja Rutnik, *What Is Dash?—a Short Guide*, ANDROID AUTHORITY (Feb. 18, 2018), https://www.androidauthority.com/what-is-dash-820943/ [https://perma.cc/X3JY-BU9R] (describing masternodes that stake cryptocurrency in exchange for voting power used to make decisions about the protocol).

36. *See, e.g.*, Vitalik Buterin, Opinion, *Bootstrapping a Decentralized Autonomous Corporation: Part I*, BITCOIN MAG., https://bitcoinmagazine.com/articles/bootstrapping-a-decentralized-autonomous-corporation-part-i-1379644274/ [https://perma.cc/AR7M-CFVG] (last visited Mar. 17, 2020) ("Bitcoin has 21 million shares, and these shares are owned by what can be considered Bitcoin's shareholders."); Daniel Larimer, *Overpaying for Security: The Hidden Costs of Bitcoin*, LET'S TALK BITCOIN! NETWORK (Sept. 7, 2013), https://letstalkbitcoin.com/is-bitcoin-overpaying-for-false-security [https://perma.cc/S6CC-YUZC] ("Think of a crypto-currency as shares in a Decentralized Autonomous Corporation (DAC) where the source code defines the bylaws.").

37. *See generally* Reyes, *Rockefeller*, *supra* note 30 (arguing that blockchain protocols, certain smart contracts, and DAOs can be structured as business trusts in order to achieve entity recognition and ensure limited liability). This Article's proposal for a contractual governance structure modeled after corporate governance mechanisms could be built into the trust instrument that creates the business trust. It could, of course, be part of an algorithmic entity that is a corporation or LLC as well. *See generally* Lynn M. LoPucki, *Algorithmic Entities*, 95 WASH. U. L. REV. 887 (2018). But it need not be. It could just be a contract employed as a governance tool for the community.

38. *See, e.g.*, Xander Landen, *Vermont Bullish on Blockchain as New Law Takes Effect*, VTDIGGER (Aug. 28, 2018), https://vtdigger.org/2018/08/28/vermont-bullish-blockchain-new-law-takes-effect/ [https://perma.cc/QPJ8-ZSWX] (describing Vermont's enactment of a law enabling "blockchain-based limited liability companies" and several companies taking advantage of the law); Ryan Taylor, *Dash Core Group Legal Structure Details*, DASH F. (Aug. 1, 2018), https://www.dash.org/forum/threads/dash-core-group-legal-structure-details.39848/ [https://perma.cc/9L7V-M6XN] (noting that the Dash Trust chose New Zealand "for its strong reputation and well-defined trust laws").

39. *See, e.g.*, *Governance Guidelines*, CORDA NETWORK FOUND., https://corda.network/governance/governance-guidelines [https://perma.cc/NVX7-G8BS] (last visited Mar. 17, 2020).

40. *See generally* DALIA TOPELSON RITVO ET AL., ORGANIZATION & STRUCTURE OF OPEN SOURCE SOFTWARE DEVELOPMENT INITIATIVES (2017), https://dash.harvard.edu/bitstream/handle/1/30805146/2017-03-24_governance.pdf [https://perma.cc/37VL-FL63]; Adam Fish et al., *Birds of the Internet*, 4 J. CULTURAL ECON. 157, 163 (2011).

This Article wrestles with the potential to create "(un)corporate crypto-governance"—blockchain governance modeled on corporate government paradigms but implemented through contracts—in three parts.[41] Part I examines the governance crisis faced by blockchain technology protocols generally and public blockchain protocols in particular. It then explores the similar experience in internet governance, which increasingly suffers from fragmentation and pressures from sovereign nations. Part II examines the parallels between the internet and the blockchain protocol governance experience and argues that corporate law offers governance guideposts[42] for solving the blockchain governance crisis. Part II argues, however, that such guideposts should be adapted and adopted by contract to uphold the ethos of the community, promote endogenous priorities, and enhance legitimacy. Part III examines the areas of blockchain technology governance that might learn most from corporate governance, including enhanced responsibilities of certain decision makers and the gatekeeping role of influential groups, individuals, and industry institutions. This Article concludes by considering the cultural challenges to governing blockchain protocols through (un)corporate crypto-governance, asserting that navigating such challenges is not only possible but also offers an opportunity to encourage new corporate governance structures in more traditional enterprises.

41. This Article follows the "cryptolaw" for blockchain technology analysis framework, asking what lessons can be drawn from corporate governance for governance of public blockchain protocols. For a full explanation of the cryptolaw for the DLT analysis framework, see generally Reyes, *Conceptualizing Cryptolaw*, *supra* note 30. For a summary version, see generally Carla L. Reyes, *Cryptolaw for Distributed Ledger Technologies: A Jurisprudential Framework*, 58 JURIMETRICS 283 (2018). This question is the inverse of the question considered in the first paper of this series. *See generally* Reyes, *Rockefeller*, *supra* note 30.

42. To be clear, this Article does not argue that blockchain protocols should be subject to corporate law unless the participants in a particular blockchain project formally incorporate. For reasons that will become clear, this Article specifically and intentionally argues for leaving blockchain governance to private ordering via contracts and encourages those creating such contracts to look to corporate governance structures for inspiration because some of the concepts and structures used in corporate governance may offer useful constructs for blockchain governance. *See infra* Part II.B. This differs markedly from the only other study of the potential use of corporate law for blockchain governance, which advocates for an Internet Corporation for Assigned Names and Numbers (ICANN)–type central regulator to oversee the imposition of a uniform corporate code to all blockchain protocols. *See generally* Phillip Hacker, *Corporate Governance for Complex Cryptocurrencies?: A Framework for Stability and Decision Making in Blockchain-Based Organizations*, *in* REGULATING BLOCKCHAIN: TECHNO-SOCIAL AND LEGAL CHALLENGES, *supra* note 21, at 140. As explained more fully below, this Article's preference for a private ordering solution follows the arguments and logic of its predecessor article, "If Rockefeller Were a Coder," because private ordering enables transparent, predictable, and endogenously chosen approaches to roles, responsibility, and liability in the governance ecosystem. *See infra* note 154. Indeed, adopting governance contracts reflects my preference for a business trust form for blockchain-based business entities. Business trusts "combine the pattern of asset partitioning provided by the traditional corporation—strong entity shielding and full limited liability—with the greater flexibility in internal structure that the corporate form has evolved to offer." Henry Hansmann et al., *The New Business Entities in Evolutionary Perspective*, 2005 U. ILL. L. REV. 5, 13–14.

I. THE OFF-CHAIN GOVERNANCE PROBLEM

Public blockchain protocol governance finds itself in a moment (or era) of crisis.[43] Eschewing the very notion of formal governance and claiming decentralization eradicated any need for it, individuals developing public blockchain protocols often created governance structures without viewing them as such.[44] As a result, the broader blockchain technical community is only beginning to investigate theories of blockchain governance in earnest.[45] To date, blockchain protocol governance predominately follows the same path as internet governance: dominance by key individuals followed by the establishment of quasi-governance organizations with overlapping missions, politicization, and varying degrees of legitimacy.[46]

At this point, however, blockchain protocol governance remains sufficiently nascent that it has not yet suffered the same degree of recentralization and interference by national governments as internet governance. In other words, there may still be time to develop governance guardrails that quell some of the conflicts of interest underlying current public blockchain protocols.[47] This Part first discusses some of the governance failures suffered by the most prominent public blockchains. This Part then uncovers the parallels between the current blockchain governance experience and the internet governance experience, demonstrating the perils that await blockchain governance if its development continues as haphazardly as it has to date, and exposing the importance of formalizing workable blockchain governance.

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43. *See* De Filippi & Loveluck, *supra* note 14, at 2.

44. Michael Abramowicz, *The Very Brief History of Decentralized Blockchain Governance*, 22 VAND. J. ENT. & TECH. L. (forthcoming 2020) (manuscript at 3) ("A blockchain is typically the result of a decentralized process for determining which transactions should be included on a ledger, and some may thus have an ideological aversion to a centralized, hierarchical governance scheme for determining how the protocol that generates this process is defined.").

45. Fred Ehrsam, *Blockchain Governance: Programming Our Future*, MEDIUM: CRYPTOCURRENCY (Dec. 1, 2017), https://medium.com/@FEhrsam/blockchain-governance-programming-our-future-c3bfe30f2d74 [https://perma.cc/EL9Z-MXBJ]; Vlad Zamfir, *Against On-Chain Governance*, MEDIUM (Dec. 1, 2017), https://medium.com/@Vlad_Zamfir/against-on-chain-governance-a4ceacd040ca [https://perma.cc/MX65-HB8P]. Academic efforts are also beginning to formally organize around the study of blockchain governance. *See, e.g.*, *Wharton Cyrptogovernance Workshop*, U. PA., https://zicklincenter.wharton.upenn.edu/wp-content/uploads/2019/05/Wharton-Cryptogovernance-Workshop-7-19.pdf [https://perma.cc/SCP6-XGQC] (last visited Mar. 17, 2020); *see also* CRYPTOECONOMIC SYSTEMS, https://cryptoeconomicsystems.pubpub.org/ [https://perma.cc/9BKM-M2WD] (last visited Mar. 17, 2020).

46. *See* discussion *infra* Part I.B.

47. Such conflicts of interest include those that led to the successful 51 percent Ethereum Classic attack. *See* Gareth Jenkinson, *Ethereum Classic 51% Attack—the Reality of Proof of Work*, COINTELEGRAPH (Jan. 10, 2019), https://cointelegraph.com/news/ethereum-classic-51-attack-the-reality-of-proof-of-work [https://perma.cc/4BZE-ZVKH] (indicating that members of the Ethereum Classic community believed "the attack was 'most likely selfish mining' noting that they had not detected any double spends at the time").

A. The Public Blockchain Protocol Governance Experience

In response to the unauthorized movement of tokens valued at $55 million from a decentralized venture capital fund called "the DAO,"[48] the Ethereum protocol underwent a hard fork[49] in 2016[50] that split the core code into Ethereum Classic and Ethereum.[51] The Ethereum hard fork wracked the Ethereum community with controversy,[52] damaging the protocol's legitimacy in the eyes of many, both within and outside the technical community.[53] On August 1, 2017, the Bitcoin blockchain also experienced a hard fork[54] that split it into Bitcoin and Bitcoin Cash.[55] A debate over how

48. Carla L. Reyes et al., *Distributed Governance*, 59 WM. & MARY L. REV. ONLINE 1, 6 (2017).

49. A "hard fork" occurs when an update to the software leads to "a clear break or discontinuity with the preceding system." De Filippi & Loveluck, *supra* note 14, at 11 n.13. This results in "two blockchain networks featuring two different and incompatible protocols." *Id.* at 8; *see also* NARAYANAN ET AL., *supra* note 12, at 73 (A hard fork is a change to the protocol that "introduces new features that were previously considered invalid" where some nodes do not upgrade such that "the old nodes will work on a branch of the block chain that excludes blocks with the new feature. . . . This type of change is called a 'hard-forking' change because it makes the block chain split."); Eric D. Chason, *Cryptocurrency Hard Forks and Revenue Ruling 2019–24*, 39 VA. TAX REV. 277, 281 (2019) ("In technical terms, a hard fork occurs when some users adopt new software that is inconsistent with past software."). Note that hard forks occur all the time. When a developer takes the source code of an open-source project, including a blockchain protocol, and forks it to create an entirely different project, a hard fork occurs. NARAYANAN ET AL., *supra* note 12, at 171, 243. Prominent examples include Namecoin and Litecoin, both hard forks from the Bitcoin blockchain. *Id.* at 247–49. Such hard forks do not pose any controversy or governance crisis. Rather, they are an expected and valuable part of open-source software development. When this Article discusses hard forks, it is primarily concerned with what some call "contentious hard forks," wherein the hard fork is a fork of an active blockchain protocol that causes controversy and uncertainty among that protocol's community and userbase. *Id.* at 75, 172–73.

50. Raina S. Haque et al., *Blockchain Development and Fiduciary Duty*, 2 STAN. J. BLOCKCHAIN L. & POL'Y 139, 163 (2019) (calling the SegWit update contentious); *see also* De Filippi & Loveluck, *supra* note 14, at 7.

51. DIEDRICH, *supra* note 13, at 293–99; Reyes et al., *supra* note 48, at 7 ("The original Ethereum blockchain continues as 'Ethereum classic' with its related ether trading at a vastly reduced price.").

52. DIEDRICH, *supra* note 13, at 289 ("Life stopped. Religious battles ensued behind the scenes as to whether [to] do nothing about the theft—because Ethereum had not failed, just the code of The DAO had turned out to be flawed!—And had not the loud and clear proclamation of the makers of the DAO been that *code is law*! Well, that law had not been broken.").

53. Ehrsam, *supra* note 45 (describing one of the downsides of hard forks as reducing trust—"[n]ow that we've had a breaking change, those previously referencing the protocol must now go outside the blockchain and somehow figure out what the 'right' new version is to use").

54. Aaron van Wirdum, *The Birth of BCH: The First Crazy Days of "Bitcoin Cash,"* BITCOIN MAG. (Aug. 2, 2017), https://bitcoinmagazine.com/articles/birth-bch-first-crazy-days-bitcoin-cash/ [https://perma.cc/YXM7-VPUL]. Bitcoin is the name used to refer to the original and dominant Bitcoin blockchain protocol. *See* Spencer Bogart, *Bitcoin vs. Bitcoin Cash: A Story of Prioritization & Healthy Competition in Money*, FORBES (Nov. 13, 2017), https://www.forbes.com/sites/spencerbogart/2017/11/13/bitcoin-vs-bitcoin-cash-a-story-of-prioritization-a-healthy-competition-in-money/ [https://perma.cc/73D3-CVZC].

55. Bitcoin Cash is the protocol that sprung into existence after the Bitcoin blockchain hard fork—it is an "offshoot" of Bitcoin. Bogart, *supra* note 54.

to scale the Bitcoin blockchain to better handle the high volume of transactions requested continues to rage,[56] and the gridlock has caused high transaction fees and excruciatingly slow processing times[57]—two of the features that allegedly make the blockchain a better system for the exchange of value.[58] Other proposals to change the core Bitcoin code led to marketplace uncertainty.[59] A cryptocurrency wallet hack[60] left approximately $280 million worth of Ether frozen and unusable, with no clear path forward for recovery.[61] The high level of controversy and the inability to reach consensus regarding key decisions on infrastructure design, security threats, and community policing have been described in the literature as parts of an ongoing governance crisis faced by public blockchain protocols.[62]

The governance problems experienced by the Bitcoin and Ethereum communities stem from conflicts of interest among governance participants. Generally, the participants in a blockchain protocol ecosystem include core developers, other open-source code contributors, full node operators,[63]

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56. De Filippi & Loveluck, *supra* note 14, at 11–12 (describing the debate and the level of ensuing controversy, often referred to as a "'civil war' within the Bitcoin community").

57. Jonald Fyookball, *Why Does Bitcoin Have Ridiculously High Fees and Slow Confirmations?*, MEDIUM (Aug. 30, 2017), https://medium.com/@jonaldfyookball/why-does-bitcoin-have-ridiculously-high-fees-and-slow-confirmations-e3fd58258a6d [https://perma.cc/LR2C-CFRP].

58. Panos Mourdoukoutas, *Could Bitcoin Replace Credit Cards?*, FORBES (Aug. 26, 2018), https://www.forbes.com/sites/panosmourdoukoutas/2018/08/26/bitcoin-could-replace-credit-cards/ [https://perma.cc/8N27-7PCK].

59. Alyssa Hertig, *Why Are Miners Involved in Bitcoin Code Changes Anyway?*, COINDESK (July 28, 2017), https://www.coindesk.com/miners-involved-bitcoin-code-changes-anyway/ [https://perma.cc/E6HG-4VZD].

60. This was actually the second hack in quick succession. In the first hack, an attacker stole approximately $30 million worth of Ether by attacking three widely used smart contracts. Santiago Palladino, *The Parity Wallet Hack Explained*, OPENZEPPELIN (July 19, 2017), https://blog.zeppelin.solutions/on-the-parity-wallet-multisig-hack-405a8c12e8f7 [https://perma.cc/YP5N-DKL9].

61. Becky Peterson, *Someone Deleted Some Code in a Popular Cryptocurrency Wallet—and as Much as $280 Million in Ether Is Locked Up*, BUS. INSIDER (Nov. 7, 2017), https://www.businessinsider.com/ethereum-parity-wallet-hack-freeze-missing-code-2017-11 [https://perma.cc/DNC6-PPQ8].

62. De Filippi & Loveluck, *supra* note 14, at 13 ("One thing is sure though: regardless of the robustness and technical viability of the Bitcoin protocol, this governance crisis and failure in conflict resolution has highlighted the fragility of the current decision-making mechanisms within the Bitcoin project.").

63. This Article uses the term "full node" or "full node operator" to refer to the operators of nodes in any blockchain protocol who possess the power to validate blocks of transactions or otherwise approve state changes and adopt software upgrades to the protocol, regardless of what those nodes are called within the protocol community. For example, in the Bitcoin blockchain system, fully validating nodes, including miners, but not SPV clients would be included. NARAYANAN ET AL., *supra* note 12, at 68–71 ("Validating a block is more complex than validating transactions. . . . Fully validating nodes must stay permanently connected so as to hear about all Bitcoin transactions. . . . Such nodes also have to store the entire block chain . . . . [In contrast,] 'Simplified Payment Verification' (SPV) clients . . . don't store the entire block chain . . . . SPV nodes can only validate transactions that actually affect them. So they're essentially trusting the fully validating nodes to have validated all the other transactions that are out there."). This Article's term "full node" would refer to the same

holders of cryptocurrency or tokens, protocol founders, and foundations.[64] The open-source developers design, create, and submit protocol updates, fixes, and modifications to the community for consideration.[65] Developers of many blockchain protocols undertake their work for free.[66] Meanwhile, full node operators enjoy the power not only to validate transactions but also to enact the core developers' updates and proposals.[67] Unlike the developers, full node operators are motivated by economic gain—the income obtained from their status as full node operators depends on both the activity of validating transactions and the receipt of transaction fees from users.[68] As a result, full node operators may have self-interested reasons for making a particular decision on a core developer proposal.[69] For example, although

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division of including fully validating nodes but not SPV clients, which, indeed, do not technically count as nodes insofar as SPV clients are actually tethered to a fully validating node and are dependent on that fully validating node to actively interact with the network. StopAndDecrypt, *Bitcoin Miners Beware: Invalid Blocks Need Not Apply*, HACKER NOON (June 1, 2018), https://hackernoon.com/bitcoin-miners-beware-invalid-blocks-need-not-apply-51c293ee278b [https://perma.cc/7XHY-V8CZ]; StopAndDecrypt, *Sharding Centralizes Ethereum by Selling You Scaling-In Disguised as Scaling-Out*, HACKER NOON (May 23, 2018), https://hackernoon.com/sharding-centralizes-ethereum-by-selling-you-scaling-in-disguised-as-scaling-out-266c136fc55d [https://perma.cc/RDL9-CHQQ] (In Ethereum 2.0, the term full node might be read to refer to only "a $16,000 node that stakes."). In a masternode protocol, the term full node, as used in this Article, would refer to the masternodes. *See, e.g.*, *How Masternodes Work*, DASH, https://www.dash.org/masternodes/ [https://perma.cc/6ZN9-PD3E] (last visited Mar. 17, 2020) ("Masternodes host full copies of the blockchain and provide a unique second layer of services to the network, facilitating advanced functions such as InstantSend, PrivateSend and usernames on the blockchain. . . . As highly committed custodians of the project, masternode operators are given the opportunity to vote each month on up to 10% of the block reward to fund community projects supporting the Dash ecosystem."). Other blockchain protocols may use different names for "fully validating nodes" within their communities, and they may have slightly different responsibilities. The term "full node" or "full node operator" is intended to be broad enough to capture these decentralized decision makers, regardless of the name used colloquially by the community in which they operate. If a community wanted to designate a subset of full nodes as responsible parties (or exclude them altogether) for one reason or another, they certainly could customize that in the governance contract.

64. NARAYANAN ET AL., *supra* note 12, at 173–75.

65. *Id.* at 171.

66. Benkler, *supra* note 2, at 372–73 ("Free software projects do not rely either on markets or on managerial hierarchies to organize production. Programmers do not generally participate in a project because someone who is their boss instructed them, though some do. They do not generally participate in a project because someone offers them a price, though some participants do focus on long-term appropriation through money-oriented activities, like consulting or service contracts. But the critical mass of participation in projects cannot be explained by the direct presence of a command, a price, or even a future monetary return, particularly in the all-important microlevel decisions regarding selection of projects to which participants contribute.").

67. NARAYANAN ET AL., *supra* note 12, at 131, 173; Vlad Zamfir, *Blockchain Governance 101*, MEDIUM: GOOD AUDIENCE (Sept. 29, 2018), https://blog.goodaudience.com/blockchain-governance-101-eea5201d7992 [https://perma.cc/3SH7-JPQC] ("[N]ode operators have to decide what software to run . . . .").

68. NARAYANAN ET AL., *supra* note 12, at 117–19 (describing the business model of mining).

69. Haque et al., *supra* note 50, at 163 ("Mining is a for-profit industry in which profits are determined in large part by the cost of computational power to mine in relation to the value of the cryptocurrency being mined. Therefore, a key factor in a miner's decision framework

the most hotly debated topic—scaling the protocols to enable faster processing and the ability to handle additional transactions—is often debated in terms of network security, the reality is that an effective scaling solution may undermine the profits of full node operators by reducing transaction fees.[70] In other words, the only group that can provide the solution may block it for reasons of pure economic self-interest.

Meanwhile, because the developers, and specifically the core developers, charged with maintaining and updating the protocol often participate in this activity for ideological reasons,[71] their view of the appropriate protocol architecture may be removed from the realities, expectations, and needs of those using the protocol—the cryptocurrency owners.[72] Notably, not all cryptocurrency owners are equally situated.[73] Some users are consumers with a passive interest in their investment,[74] others build applications or other businesses related to their ownership, such as wallet providers and exchange operators.[75] The business holders,[76] with larger holdings, may hold a different view on governance issues than individual and more apathetic users.[77] A protocol founder, or a foundation designed to promote the protocol or undertake research and advocacy related to the protocol, may support one position over another in a particularly difficult or highly charged matter.[78]

In an attempt to more consciously address these conflicting interests in their communities, public blockchain protocols generally choose between

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(i.e., which version of the software application to run and which history to adopt) is the effect that a certain proposed code change will have on the value of the cryptocurrency.").

70. NARAYANAN ET AL., *supra* note 12, at 130–36 (describing mining incentives and strategies, including attacks on the protocol for the economic benefit of the miner).

71. *Id.* at 175–76.

72. Zamfir, *supra* note 67 (describing core developers' primary interest in preserving the quality of their software repositories so that their code is used and preferred above the code provided by others). Core developers, like open-source software developers more broadly, predominately engage in a reputation game. Benkler, *supra* note 2, at 424–25.

73. *See* Reyes, *Rockefeller*, *supra* note 30, at 393–94.

74. *Id.*

75. NARAYANAN ET AL., *supra* note 12, at 174 (describing merchants and payment services).

76. These may include block explorers, exchanges, and application developers, among others. Zamfir, *supra* note 67.

77. NARAYANAN ET AL., *supra* note 12, at 174.

78. *Id.* at 174–75. The DAO incident evidences some of the conflicts of interest that can manifest when questions of protocol management arise. The DAO, a decentralized venture capital firm, operated through computer code on top of the Ethereum protocol. Reyes et al., *supra* note 48, at 4–6. When one of the members of the firm used loopholes in the DAO's computer code to siphon off $55 million worth of the DAO's assets, the event forced the Ethereum community to make a governance decision: should the underlying Ethereum protocol be revised to reflect the state of transactions before the DAO's creation or should the DAO participants be forced to accept the consequences of their investment gone wrong? The community eventually chose to revise the protocol via a hard fork, but not without extensive discussion, maneuvering, and politics among the core developers, miners, and userbase. Walch, *In Code(rs) We Trust*, *supra* note 21, at 60–64.

two types of governance: "on-chain" and "off-chain."[79] On-chain governance generally refers to attempts to hard code governance rules into the consensus mechanism used to confirm transactions conducted on the protocol.[80] Generally speaking, however, on-chain governance mechanisms are new, experimental, and in very early stages of development.[81] Most governance of the leading public blockchain protocols takes place off-chain.[82] Off-chain governance refers to the governance processes that take place outside of the code and are generally used to make decisions about whether and how to make updates to the core protocol code.[83] Off-chain governance mechanisms have come under increasingly heavy criticism from both technical and academic experts who that the mechanisms have grown up in a haphazard way that may not be optimal.[84] Even without taking a position in the debate regarding whether on- or off-chain governance will work better in the long run,[85] public blockchain protocols cannot wait for on-chain mechanisms to prove effective. Any on-chain governance mechanism beyond the consensus mechanism for validating transactions is difficult to implement.[86] If public blockchain protocol communities wait for on-chain systems to be perfected, they risk imposition of an off-chain governance mechanism by regulators that does not fit their ethos, purposes, or values.[87] When codes of conduct are imposed on open-source software projects from the outside, the results can be disastrous.[88]

This is a pivotal moment for blockchain technology. Disagreement about how blockchain protocol governance should proceed makes protocols

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79. Pool of Stake, *Revisiting the On-Chain Governance vs. Off-Chain Governance Discussion*, MEDIUM (May 22, 2018), https://medium.com/@poolofstake/revisiting-the-on-chain-governance-vs-off-chain-governance-discussion-f68d8c5c606 [https://perma.cc/72MB-JEL6].

80. *Id.*

81. Brian Curran, *What Is Blockchain Governance?: Complete Beginner's Guide*, BLOCKONOMI (Sept. 21, 2018), https://blockonomi.com/blockchain-governance/ [https://perma.cc/78B6-BTB5]; *see also* Reijers et al., *supra* note 26, at 1–2.

82. *See* Reijers et al., *supra* note 26, at 1–2.

83. Pool of Stake, *supra* note 79.

84. Curran, *supra* note 81; Ehrsam, *supra* note 45; *On-Chain Governance*, INVESTOPEDIA, https://www.investopedia.com/terms/o/onchain-governance.asp [https://perma.cc/77CM-H4B4] (last visited Mar. 17, 2020).

85. *See* Zamfir, *supra* note 45 (against on-chain governance); *cf.* Ehrsam, *supra* note 45 (in favor of on-chain governance).

86. *See, e.g.*, *Learn About Tezos*, TEZOS, https://tezos.com/get-started [https://perma.cc/6699-MLEY] (last visited Mar. 17, 2020); Aaron Stanley, *EOS: Unpacking the Big Promises Behind a Possible Blockchain Contender*, COINDESK (June 25, 2017), https://www.coindesk.com/eos-unpacking-the-big-promises-behind-a-possible-blockchain-contender [https://perma.cc/BM6F-2E6R].

87. *See generally* Walch, *In Code(rs) We Trust*, *supra* note 21 (arguing that core developers and node operators should shoulder fiduciary duties); Wolfie Zhao, *CFTC Official Warns Smart Contract Designers over Predictive Code*, COINDESK (Oct. 17, 2018), https://www.coindesk.com/cftc-official-warns-smart-contract-designers-over-predictive-code [https://perma.cc/QR2S-9TGP]; Complaint, *supra* note 22, at 11–12.

88. *Linux Developers Threaten to Pull "Kill Switch,"* LULZ (Sept. 24, 2018), https://lulz.com/linux-devs-threaten-killswitch-coc-controversy-1252/ [https://perma.cc/4CK8-LDBC].

inflexible and slow to adapt[89] and, if not resolved, may impact future adoption.[90] Further, the use of hard forks to rescue user funds has led to claims that core developers must rescue funds when possible or face a class action lawsuit.[91] As a result, the governance crisis now poses a threat not just to the technical function of blockchain protocols but also to the broader system of open-source software development.[92] Blockchain technology protocols are not the first open-source protocol to face such governance problems on a global scale. In fact, the development of blockchain governance to date traces a very similar path as that of internet governance. If blockchain governance development does not proceed carefully from this point, it may fall victim to some of the same perils to which the internet succumbed.

B. The Path of Internet Governance and Its Perils

Commentators often compare blockchain protocols to the Internet Protocol.[93] Blockchain protocols set the rules that allow computers to interact with each other regarding the exchange of value on a peer-to-peer basis, in much the same way the internet sets the rules that allow computers to exchange information on a peer-to-peer basis.[94] Further, many blockchain protocols, like the internet, are, at launch, "generative: they were designed to accept any contribution that followed a basic set of rules."[95] Some, therefore, recommend that blockchain governance follow the path of internet governance.[96] However, even a brief review of the development of current internet governance mechanisms reveals certain shortcomings that blockchain protocol governance would do well to avoid.[97] In particular,

89. Nick Tomaino, *The Governance of Blockchains*, MEDIUM (Feb. 28, 2017), https://thecontrol.co/the-governance-of-blockchains-5ba17a4f5da6 [https://perma.cc/M8YW-PU3N].

90. Simon Chandler, *Why Blockchain Adoption Is Slow, and Why That's Nothing to Worry About*, CRYPTONEWS (Apr. 15, 2018), https://cryptonews.com/exclusives/why-blockchain-adoption-is-slow-and-why-that-s-nothing-to-wo-1577.htm [https://perma.cc/SMQ8-98YS] (noting that some lack of adoption stems from the scaling problem faced by public blockchains, which has remained unsolved by off-chain governance of those protocols).

91. Complaint, *supra* note 22, at 3–4, 24–25.

92. Benkler, *supra* note 2, at 381–400.

93. Marco Iansiti & Karim R. Lakhani, *The Truth About Blockchain*, HARV. BUS. REV. (Jan.–Feb. 2017), https://hbr.org/2017/01/the-truth-about-blockchain [https://perma.cc/MR6F-LBUM].

94. For definitional clarity on the term "protocol," see GALLOWAY, *supra* note 12, at 74–75.

95. ZITTRAIN, *supra* note 29, at 3.

96. *See generally* Hacker, *supra* note 42 (recommending the creation of an ICANN for blockchain technology in order to create and implement a universal corporate governance code).

97. The term "internet governance" holds different meanings and implications for different people. As a result, many differences of opinion exist regarding precisely which features of internet governance are strengths and which are weaknesses. The account presented here represents one such interpretation, well-grounded in the relevant literature, of internet governance, its history, and its implications for our present experience and future expectations.

critics of modern-day internet governance denounce the recentralization of the internet,[98] the lack of institutional legitimacy,[99] and the increasing politicization of internet governance and[100] argue that the chosen governance mechanisms allowed inappropriate intervention by sovereign governments and the fragmentation of what was intended to be a global, borderless network.[101]

Like the definition of blockchain governance, the definition of internet governance remains contested.[102] The United Nations Working Group on Internet Governance defines internet governance as "the development and application by Governments, the private sector, and civil society, in their respective roles, of shared principles, norms, rules, decision-making

98. Milton Mueller, Commentary, *ICANN and Internet Regulation*, 42 COMM. ACM 41, 43 (1999) ("In short, we have come a long way since the days when the Internet was touted as a totally decentralized, self-governing system that could simply route around any attempts to control it. The levers of control have been exposed for all to see, and ICANN's tumultuous and fascinating evolution is the best place to watch how an increasingly globalized society balances the need for open communication with demands for centralized control."). *See generally* ZITTRAIN, *supra* note 29 (warning against the increasing centralized architecture of the internet); Félix Tréguer, *Gaps and Bumps in the Political History of the Internet*, INTERNET POL'Y REV., Oct. 2017, at 1, 3–4 (describing the scholarship of Jonathan Zittrain, Yochai Benkler, and Tim Wu as exploring "whether the internet, despite its countless founding techno-utopias about its subversive and democratic potential, was undergoing the same process of 'feudalisation' as past information technologies, and how law and policy might help stop that fate").

99. *See, e.g.*, Jonathan Weinberg, *ICANN and the Problem of Legitimacy*, 50 DUKE L.J. 187, 212–17 (2000).

100. GOLDSMITH & WU, *supra* note 29, at 46 (describing the events that led to the issuance of the U.S. "Green Paper" on internet root control and concluding that "[t]he Green Paper marked the beginning of a different age of the Internet, one in which powerful governments would begin to use threats of force to make their wills known"); MILTON L. MUELLER, NETWORKS AND STATES: THE GLOBAL POLITICS OF INTERNET GOVERNANCE 1 (2010) ("A distinctive global politics is developing around the Internet. Like global trade and environmental policy, Internet governance has become a point of international conflict among states and a target of transnational policy advocates from business and civil society.").

101. *See, e.g.*, Dmitry Epstein, *The Making of Institutions of Information Governance: The Case of the Internet Governance Forum*, 28 J. INFO. TECH. 137, 139 (2013) ("For many in the Internet community, particularly those belonging to the old guard of Internet designers and those viewing the Internet in more libertarian terms, the growing interest of governments in issues of Internet governance, specifically the calls to implement a more nation-state focused and hierarchical decision-making process, was an assault on the very spirit of the Internet and its normative foundations."); *see also* GOLDSMITH & WU, *supra* note 29, at 181–82 ("The Internet was supposed to be the test case for self-governing systems that could flourish without respect to geography and territorially based coercion. It was supposed to allow like-minded people to join communities and govern themselves without respect to geography, without regard to the top-down coercive structures of territorial governmental systems, and without the usual pathologies and corruptions that characterize territorial rule. . . . Our peek below the surface of eBay's self-governing façade revealed a far different story—a story of heavy reliance on the iron fist of coercive governmental power.").

102. Lee A. Bygrave, *Introduction*, *in* INTERNET GOVERNANCE: INFRASTRUCTURE AND INSTITUTIONS 1, 2 (Lee A. Bygrave & Jon Bing eds., 2009). Or, as one study puts it, "there is no shortage of available definitions for Internet governance . . . ." ANRI VAN DER SPUY, WHAT IF WE ALL GOVERNED THE INTERNET?: ADVANCING MULTISTAKEHOLDER PARTICIPATION IN INTERNET GOVERNANCE 16 (2017), https://en.unesco.org/sites/default/files/what_if_we_all_governed_internet_en.pdf [https://perma.cc/XKJ9-9C5P].

procedures and programmes, that shape the evolution and utilization of the Internet."[103] Variations of this definition abound.[104] Arguably, internet governance encompasses both questions of infrastructure (or architecture) and questions of content modulation.[105] Because commonalities in questions related to infrastructure governance dominate the parallel between blockchain protocol governance and internet governance, this Part focuses on the path of internet infrastructure governance.

The original architects of the internet designed it to be "open, minimalist, and neutral."[106] Those design principles reflected the ideology of the internet's creators[107]—an ideology that distrusted centralized control and reflected libertarian ideals.[108] That ideology also affected governance mechanisms for determining whether and how to make design changes; rather than vote, the architects argued until they reached a rough consensus.[109] Initially, certain individuals exerted a large measure of control over internet design and architectural decisions.[110] Over time, these

103. WORKING GRP. ON INTERNET GOVERNANCE, REPORT OF THE WORKING GROUP ON INTERNET GOVERNANCE 4 (2005), https://www.wgig.org/docs/WGIGREPORT.pdf [https://perma.cc/ZFE2-5JR6]. This definition closely models that adopted as the working definition in the "Tunis Agenda for the Information Society": "[T]he development and application by governments, the private sector and civil society, in their respective roles, of shared principles, norms, rules, decision-making procedures, and programmes that shape the evolution and use of the internet." GLOB. COMM'N ON INTERNET GOVERNANCE, ONE INTERNET 1 (2016), https://www.cigionline.org/sites/default/files/gcig_final_report_-_with_cover.pdf [https://perma.cc/H687-YCGF].

104. *See, e.g.*, MILTON MUELLER ET AL., MAKING SENSE OF "INTERNET GOVERNANCE": DEFINING PRINCIPLES AND NORMS IN A POLICY CONTEXT 4 (2004) (defining internet governance as "[c]ollective action, by governments and/or the private sector operators of TCP/IP networks, to establish rules and procedures to enforce public policies and resolve disputes that involve multiple jurisdictions" (emphasis omitted)); Marius Kalinauskas & Mantas Barčys, *Interaction Between National Governments and ICANN While Administering the Internet*, 3 SOC. TECHNOLOGIES 432, 435 (2013) (taking the position that the term internet governance lacks a useful definition but "stands mainly for the global technical management of the core resources of the Internet: domain names, IP addresses, Internet protocols, and the root server system"); *see also* MUELLER, *supra* note 100, at 8–10 (discussing the evolving nature of the term "Internet governance").

105. Bygrave, *supra* note 102, at 2.

106. GOLDSMITH & WU, *supra* note 29, at 23.

107. ZITTRAIN, *supra* note 29, at 28 ("The design of the Internet reflected not only the financial constraints of its creators, but also their motives.").

108. GOLDSMITH & WU, *supra* note 29, at 23.

109. ZITTRAIN, *supra* note 29, at 28 ("The network's design was publicly available and freely shared from the earliest moments of its development. If designers disagreed over how a particular protocol should work, they would argue until one had persuaded most of the interested parties. The motto among them was, 'We reject: kings, presidents, and voting. We believe in: rough consensus and running code.'").

110. Lee A. Bygrave & Terje Michaelsen, *Governors of Internet*, *in* INTERNET GOVERNANCE: INFRASTRUCTURE AND INSTITUTIONS, *supra* note 102, at 92, 93 ("The reference to 'individual members' underlines the fact that governance in this first generation has been exercised under the relatively strong influence of individual persons. These persons have been able, alone and together, to make their mark over and above the organizations to which they have been attached. Prominent examples include Jon Postel, Vinton Cerf, and Tim Berners-Lee."); *see also* GOLDSMITH & WU, *supra* note 29, at 22 ("At the same time that John Perry Barlow and Julian Dibbell were teaching the world about cyberspace self-rule, a crucial group of non-governmental actors was already exercising extraordinary powers of Net

individuals ceded their roles to more formal organizations.[111] Those organizations center their efforts on creating, maintaining, and developing the core protocols for internet communication, guarding the design principles viewed as key elements of those core protocols, and preserving the ethos of decision-making that guided the early internet—"rough consensus and running code."[112] Such organizations include the Internet Society, formed in 1992 with Vinton Cerf leading the charge;[113] the World Wide Web Consortium ("W3C"), established in 1994 by Tim Berners-Lee;[114] and the Internet Assigned Numbers Authority, which organically emerged as the creation of Jon Postel in 1988.[115] Other interrelated organizations also emerged, including the Internet Architecture Board, the Internet Engineering Task Force, the Internet Engineering Steering Group, and the Internet Research Task Force, among others.[116] Notably, up until the late 1990s, few of these internet governance organizations maintained close ties to any national government.[117]

Then, in 1998, the Internet Corporation for Assigned Names and Numbers (ICANN) incorporated as a California nonprofit public benefit corporation.[118] ICANN's formation remains the subject of critique and controversy.[119] ICANN emerged as a solution to a situation viewed as a

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governance. . . . They were as native to the Internet as it is possible to be, for these were the storied 'founders' of the Internet itself—men like Larry Roberts, Robert Kahn, Vint Cerf, Jon Postel, and Dave Clark."); *id.* at 29–46 (describing Jon Postel as "the God of the Internet"). For a deeper dive into the individual founders of the internet and their initial governance roles, see generally KATIE HAFNER & MATTHEW LYON, WHERE WIZARDS STAY UP LATE: THE ORIGINS OF THE INTERNET (1996).

111. Bygrave & Michaelsen, *supra* note 110, at 93–103.

112. *Id.* at 93–94.

113. *Id.* at 95.

114. *Id.* at 101. *See generally* BERNERS-LEE, *supra* note 7.

115. Bygrave & Michaelsen, *supra* note 110, at 103.

116. *Id.* at 96–102; *see also* Ingo Take, *Regulating the Internet Infrastructure: A Comparative Appraisal of the Legitimacy of ICANN, ITU, and the WSIS*, 6 REG. & GOVERNANCE 499, 504 (2012) (explaining that the International Telecommunication Union (ITU) is responsible for formulation of technical standards for information and communication technology while the United Nations World Summit on the Information Society (WSIS) aims to manage the conflict between ITU and ICANN).

117. Bygrave & Michaelsen, *supra* note 110, at 92 ("All in all, it is a governance structure reflecting both the Internet itself and its history of development. Concomitantly, the governance structure is relatively unencumbered by dirigiste ideology. While tentacles of government control are visible, private sector bodies have usually been permitted—and, indeed, often encouraged—to play the lead role in design and management of the Internet."); *see also* Take, *supra* note 116 (describing ITU, ICANN, and WSIS, wherein ICANN, as further discussed below, is the only organization linked directly to a specific nation).

118. Bygrave & Michaelsen, *supra* note 110, at 103.

119. *See, e.g.*, Mueller, *supra* note 98, at 42; Milton L. Mueller & Farzaneh Badiei, *Governing Internet Territory: ICANN, Sovereignty Claims, Property Rights and Country Code Top-Level Domains*, 17 COLUM. SCI. & TECH. L. REV. 435, 449 (2017) ("The newly-formed ICANN viewed itself as carrying on Postel's legacy as a global governing authority based on private contracts . . . . But Postel's halo failed to rub off on ICANN. Incumbent ccTLD delegees, especially those that were independent of state authority, resisted any arrangement that would give ICANN (or the local government) the ability to expropriate or regulate them.").

crisis threatening the efficacy of internet governance.[120] In the face of increasing commercial use of the internet, the ad hoc management of the domain name system that prevailed at the time came under fire from industry, national governments, and technologists.[121] The U.S. Department of Commerce stepped in, calling for "a new entity to assume the primary responsibility for the management of internet names and addresses."[122] ICANN's creation[123] solved the riddle of domain name system management[124] and answered the Department of Commerce's call[125] by formalizing control of the domain name system (DNS).[126] Increasingly, however, commentators critique ICANN for allowing U.S. dominance,[127] lacking accountability,[128] and lacking transparency.[129] These critiques bely

120. FRANCES CAIRNCROSS, THE DEATH OF DISTANCE: HOW THE COMMUNICATIONS REVOLUTION IS CHANGING OUR LIVES 85 (2001) ("Unlike the IETF, ICANN did not grow organically from the grassroots up. And unlike W3C, it was not the initiative of a single Web pioneer. Instead, it was set up in 1998 to end a row over the way the allocation of electronic addresses was managed."); Epstein, *supra* note 101, at 138 ("Thus, at the end of the 1980s and early 1990s a set of tensions arose between the loose institutions of Internet governance and the US government. Those tensions centered primarily on the question of authority over the domain name system (DNS) hierarchy and were fueled by the shift of power balance in favor of commercial, as opposed to government or educational, interests in the Internet.").

121. Bygrave & Michaelsen, *supra* note 110, at 104.

122. Emily M. Weitzenboeck, *Hybrid Net: The Regulatory Framework of ICANN and the DNS*, 22 INT'L J.L. & INFO. TECH. 49, 51 (2014).

123. For a detailed history of ICANN's creation, which is beyond the scope of this Article, see DAVID LINDSAY, INTERNATIONAL DOMAIN NAME LAW: ICANN AND THE UDRP (2007) and MILTON L. MUELLER, RULING THE ROOT: INTERNET GOVERNANCE AND THE TAMING OF CYBERSPACE 73–205 (2002).

124. Take, *supra* note 116, at 504–05 ("As a private organization, ICANN has been charged with the allocation and administration of domain names since 1998. Furthermore, the mission of ICANN includes introducing and promoting competition in the registration of domain names within the generic top-level domain (gTLD)-areas (.com, .org, .net, etc.).").

125. Weitzenboeck, *supra* note 122, at 51.

126. Bygrave & Michaelsen, *supra* note 110, at 103–13.

127. Steve DelBianco & Braden Cox, *ICANN Internet Governance: Is It Working?*, 21 PAC. MCGEORGE GLOBAL BUS. & DEV. L.J. 27, 41 (2008) (describing critiques that the United States has undue influence over ICANN and the critical internet infrastructure it manages); *see also* Bygrave & Michaelsen, *supra* note 110, at 108, 112 ("One of the main objections to the ICANN regime has been the central role played by the US government in its development."); Konstantinos Komaitis, *ICANN: Guilty as Charged?*, J. INFO. L. & TECH., July 4, 2003, at 1; Weitzenboeck, *supra* note 122, at 51–52 (describing the origins of the heavy U.S. influence over ICANN). Notably, in 2014, amidst mounting criticism of its overinvolvement, the United States announced that it would terminate its control of the root and turn over ICANN control to the "global multistakeholder community." Mueller & Badiei, *supra* note 119, at 465. The transition occurred on October 1, 2016. *Id.*

128. *See, e.g.*, Epstein, *supra* note 101, at 138 ("The still ongoing debate over the shape of the governance system of the Internet is to a great extent a debate over the shape of the network itself. . . . It is a debate over legitimacy of decision-making processes and institutions concerned with the Internet."). *But see generally* Bygrave & Michaelsen, *supra* note 110, at 111 ("ICANN has been accused of . . . failing to give civil society groups adequate representation in its policy development."); C. N. J. de Vey Mestdagh & R. W. Rijgersberg, *Rethinking Accountability in Cyberspace: A New Perspective on ICANN*, 21 INT'L REV. L. COMPUTERS & TECH. 27 (2007) (arguing that these critiques may be misdirected).

129. Bygrave & Michaelsen, *supra* note 110, at 111 ("Another category of criticism concerns ICANN's modus operandi. ICANN has been accused of opaque, slow, and arbitrary decision making—particularly with regard to the issue of root extension . . . ."); Take, *supra*

a broader concern regarding widespread interference of national governments in the further design of the internet.[130] As governments use their coercive power,[131] they begin to "establish different visions of what the Internet might be. In so doing, they will attract other nations to choose among models of control . . . . The result is the beginning of a technological version of the cold war, with each side pushing its own vision of the Internet's future."[132] This history of internet governance and its perils holds important lessons for the future of blockchain protocol governance.

II. THE PROMISE OF CORPORATE GOVERNANCE

Having reviewed the history of off-chain governance in the blockchain technology context and the tumultuous history of internet governance, this Part considers the parallels between the two. Concluding that the internet governance experience offers a prophetic picture of future blockchain protocol governance absent some structured intervention, this Part explores the functional equivalency shared by blockchain protocols and corporations. Finding functional equivalency in key areas and recognizing the shared governance problem as one of managing conflicts of interest between owners and managers, this Part points to the promise of corporate governance paradigms as models for contractual solutions to the blockchain governance crisis.

A. Blockchain Technology's Governance Path Mirrors That of the Internet

The parallel between the development of the internet and the development of blockchain protocols is clear.[133] Both technologies are protocol technologies.[134] Both technologies were released in what has been described as a nascent or underdeveloped stage.[135] Both technologies enable peer-to-

note 116, at 507 ("[O]thers criticize the insufficient coordination of information flows and the weakly institutionalized cooperation with members and external stakeholders."); *see also* MUELLER, *supra* note 100, at 248 ("ICANN as it currently functions is a parody of a bottom-up consensus-building governance institution; the only real accountability comes from the nuclear option of an alternative root system.").

130. *See, e.g.*, GOLDSMITH & WU, *supra* note 29, at 179–84; Mueller & Badiei, *supra* note 119, at 484 ("Pure sovereignty would also pose greater risks for the global compatibility of the DNS.").

131. Milton Mueller and Farzaneh Badiei detail the efforts of states to claim sovereignty over country-code top-level domain (ccTLD) delegations: "Have states nevertheless succeeded in exploiting the isomorphism between the ISO-3166 codes and political geography to successfully assert more authority over ccTLD delegations than they originally had? Yes, and their agenda was strongly aided by the preeminent position of one sovereign, the United States, in the ICANN regime." Mueller & Badiei, *supra* note 119, at 489.

132. GOLDSMITH & WU, *supra* note 29, at 184.

133. *See* Iansiti & Lakhani, *supra* note 93.

134. Daniel Folkinshteyn et al., *A Tale of Twin Tech: Bitcoin and the WWW*, 10 J. STRATEGIC & INT'L STUD. 82, 84 (2015) (using the term "protocol" to describe both the internet and the Bitcoin blockchain).

135. *Id.* at 86 (referring to the internet as a "nascent technology"); Iansiti & Lakhani, *supra* note 93 (asking if "blockchain [is] decades from reaching its full potential").

peer exchange.[136] Both technologies embed libertarian values into the code.[137] Neither technology is controlled by a single actor.[138] Early governance of both technologies sits atop an ethos of "rough consensus and running code"[139] and the dominating influence of certain key individuals.[140] Those early, ad hoc elements of governance[141] gave way to formalized governance organizations over time.[142] And each suffered a governance crisis relating to the ability to make important architectural decisions.[143]

Public blockchain protocols currently sit at such an early stage of development; however, no governance solutions have been fully implemented.[144] The internet, on the other hand, is far past that. The results of internet governance efforts to date have been mixed, with many critics pointing out the perils of national government interference, recentralization, and increasing politicization as ways that internet governance structures fail to uphold the original vision of the internet.[145] Ultimately, Professor Jonathan Zittrain warns that, as a result of the current system,

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136. Folkinshteyn et al., *supra* note 134, at 85 ("Just like the World Wide Web, which allowed for decentralized, permissionless participation and innovation in the information space, the Bitcoin system allowed for the same in the currency space." (citation omitted)).

137. *See* Jack Filiba, *Blockchain Is the Internet's Legacy Through the Internet of Value*, COINSQUARE (Dec. 14, 2017), https://news.coinsquare.com/blockchain/blockchain-internet-of-value/ [https://perma.cc/ZWD6-YNVT] (explaining that blockchain technology holds the potential to realize John Perry Barlow's "cyber-libertarian" vision for the internet).

138. *See* Take, *supra* note 116, at 504; Iansiti & Lakhani, *supra* note 93 ("A team of volunteers around the world maintains the core [Bitcoin Blockchain] software.").

139. ZITTRAIN, *supra* note 29, at 28; *see also* Epstein, *supra* note 101, at 137; Taylor Pearson, *The Downside of Democracy (and What It Means for Blockchain Governance)*, COINDESK (June 22, 2018, 8:58 AM), https://www.coindesk.com/downside-democracy-means-blockchain-governance/ [https://perma.cc/NH2S-79C2].

140. Folkinshteyn et al., *supra* note 134, at 82–84 (comparing the role of Tim Berners-Lee in forming the W3C to that of Satoshi Nakamoto in forming the Bitcoin blockchain).

141. Epstein, *supra* note 101, at 137 ("The governance structures informally developed during the design of the Internet supported substantially different mechanisms of policy deliberation and decision-making, compared with traditional, formal state-centric structures."); Pearson, *supra* note 139 (describing governance of public blockchain protocols as quintessentially open-source governance).

142. Bygrave & Michaelsen, *supra* note 110, at 93–103 (describing how the individual founders of key pieces of internet infrastructure ceded their roles to organizations); *see also* Folkinshteyn et al., *supra* note 134, at 86 (describing the rise of a standards body that maintains the Bitcoin blockchain protocol).

143. Lawrence B. Solum, *Models of Internet Governance*, *in* INTERNET GOVERNANCE: INFRASTRUCTURE AND INSTITUTIONS, *supra* note 102, at 48, 59–60 (describing the internet governance crisis suffered when governance of DNS by one individual, Jon Postel, could not be scaled to meet demand, leading to the creation of ICANN); *see also* De Filippi & Loveluck, *supra* note 14, at 18–19 (describing Bitcoin's own governance crisis around the issue of scaling).

144. Notably, some internet governance institutions seem to be attempting to bring blockchain governance within their domain already, including the United Nations Internet Governance Forum and W3C, among others. *See, e.g.*, *Dynamic Coalition on Blockchain Technologies (DC-Blockchain)*, INTERNET GOVERNANCE F., https://intgovforum.org/multilingual/content/dynamic-coalition-on-blockchain-technologies-dc-blockchain [https://perma.cc/2WNH-XST5] (last visited Mar. 17, 2020). *See generally Blockchain Community Group*, W3C COMMUNITY & BUS. GROUPS, https://www.w3.org/community/blockchain/ [https://perma.cc/8GD8-DACY] (last visited Mar. 17, 2020).

145. *See supra* notes 98–100 and accompanying text.

> the pieces are in place for a wholesale shift away from the original chaotic design [of the internet] that has given rise to the modern information revolution. This counterrevolution would push mainstream users away from a *generative* Internet that fosters innovation and disruption, to an *appliancized* network that incorporates some of the most powerful features of today's Internet while greatly limiting its innovative capacity—and, for better or worse, heightening its regulability.[146]

Blockchain communities already express concern about this eventuality for blockchain technology.[147] In a series of blog posts, Ethereum protocol researcher Vlad Zamfir outlined several potential paths blockchain governance might take, including: autonomous blockchains (those with fully on-chain governance); capture of blockchain governance by a corporation, by government, by the core developers, or by a cartel of participants; governance via public international law; or governance via international private cooperation.[148] Zamfir warns that autonomous blockchains pose a threat to their public userbases.[149] Zamfir also advocates for blockchain governance that avoids capture by one or more actors out of fear that blockchains will then merely serve "a narrow group of stakeholders who are served by the governance of the capturing entity."[150] Indeed, as a protocol technology, blockchain technology suffers the same susceptibility to command and control hierarchies as the internet.[151] A protocol is "a set of instructions for the compilation and interaction of objects."[152] As a result, it represents the outcome of a careful negotiation that determines which information flows subordinate to others—the protocol itself is a form of dominance and hegemony.[153] The power of that hegemony can be applied for the betterment or to the detriment of the individuals using the network governed by the protocol. Good governance represents the key to ensuring that the protocol's power works to society's benefit and not to its detriment.

If blockchain protocol governance follows the same path as the internet, the very qualities of blockchain technologies that spur innovation and

146. ZITTRAIN, *supra* note 29, at 8.

147. Zamfir, *supra* note 67; Vlad Zamfir, *My Intentions for Blockchain Governance*, MEDIUM (Oct. 4, 2018), https://medium.com/@Vlad_Zamfir/my-intentions-for-blockchain-governance-801d19d378e5 [https://perma.cc/7R3K-VPLW]; *see also* CleanApp, *Blockchain Governance 102: Response to Vlad Zamfir's Blockchain Governance 101*, MEDIUM (Oct. 2, 2018), https://medium.com/cryptolawreview/blockchain-governance-102-9912a88da91d [https://perma.cc/7YX8-JS3F].

148. Zamfir, *supra* note 67.

149. Zamfir, *supra* note 147 ("I'm certain that autonomous blockchains will be inevitably weaponized, and I'm also sure that it is our responsibility to do what we can to prevent people from attacking innocent bystanders using our software as a weapon. At an absolute minimum.").

150. *Id.*

151. GALLOWAY, *supra* note 12, at 13 ("While protocol may be more *democratic* than the panopticon in that it strives to eliminate hierarchy, it is still very much structured around command and control and therefore has spawned counter-protocological forces.").

152. *Id.* at 75.

153. *Id.*

promise disruption may be quashed before they ever fully develop.[154] Current proposals to prevent that outcome purport to impose fiduciary duties on open-source software developers unilaterally, without an obvious distinction between developers in the blockchain context and the open-source movement more broadly.[155] Such proposals[156] threaten the very important source of innovation society finds in the open-source software movement. The key to moving forward lies in finding a governance model nimble enough to be "hacked"—modified and customized to reflect endogenous priorities and values[157]—while also remaining readily recognizable to legal structures in order to prevent certain unhelpful forms of capture. Herein lies the promise of using a corporate governance model to privately order blockchain governance by contract.[158]

B. Corporate Governance as Blockchain Governance

In light of the difficult blockchain governance experience to date and the perils currently faced as a result of internet governance failures, why turn to corporate governance paradigms to inform a model for governance of public blockchains? While other rationales exist,[159] this Article considers five key reasons for turning to a corporate governance model for blockchains. First, this Article argues not that corporate laws should apply but that formal governance contracts should be adopted that use corporate governance structures as inspiration. The idea is to use existing contract law, known for flexibility and respect for parties' informed choices, to create governance

154. To that end, I neither favor Zamfir's outcomes of governance via international law nor the version of governance by international private ordering presented in his blog post (governance via ICANN, the Internet Governance Forum, W3C, etc.). *See* Zamfir, *supra* note 67. International law is notoriously slow to function and frequently fails to mediate disputes in ways that prevent national governments from taking further action. Thus, government capture remains a strong possibility in the international governance scenario or in any version of international private ordering that relies on the actions of international institutions. *See, e.g.*, Carla L. Reyes, Comment, *International Governance of Domestic National Security Measures: The Forgotten Role of the World Trade Organization*, 14 UCLA J. INT'L L. & FOREIGN AFF. 531, 557–59 (2009) (detailing the International Court of Justice's inability to enforce international law during the Nicaraguan conflict). Instead, this Article argues for true international private ordering based in contract, so it can be flexible and more nimble than international governance. This Article further urges blockchain protocol communities to consider using certain existing corporate governance paradigms because they boast a history of use, trial and error, and a large body of related theoretical and jurisprudential research.

155. *See generally* Walch, *Call Blockchain Developers What They Are*, *supra* note 21.

156. Note that such proposals can be viewed as a form of the government capture that Zamfir seeks to avoid. *See* Zamfir, *supra* note 67; Zamfir, *supra* note 147.

157. Elizabeth Pollman, *The Rise of Regulatory Affairs in Innovative Startups* 6 (Loyola Law Sch., L.A. Legal Studies Research Paper No. 2016-43, 2017), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2880818 [https://perma.cc/GVN4-F3BR] ("In reality, hacking just means building something quickly or testing the boundaries of what can be done." (quoting Facebook, Inc., Registration Statement (Form S-1) 69 (Feb. 1, 2012) (letter from Mark Zuckerberg))).

158. Fundamentally, this Article's proposal is a form of international private cooperation; it is simply a different form than that initially envisioned by Zamfir. *See* Zamfir, *supra* note 67.

159. *See generally* Hacker, *supra* note 42.

regimes that assign roles, responsibilities, and liabilities in ways chosen and agreed to by the members of each specific blockchain protocol community. This allows a "hackable"[160] model of blockchain governance—resting in contract, it can push the bounds of what currently exists and can be modified and customized to fit the community's needs, values, and priorities.[161] That these contracts use corporate governance for design inspiration represents only one potential model, but one which is rooted in the history and discourse of blockchain technology specifically and open-source software development more broadly. Indeed, the second reason to consider a corporate governance model rests on the nature and purpose of corporations and the way the blockchain community often describes the nature and purpose of blockchain protocols, which reveals blockchain technology as the functional equivalent[162] of a corporation.[163] Third, the corporate governance model is one regularly adopted by the most robust open-source software development projects, including Linux and Apache.[164] Fourth, some protocols may be developed as freestanding legal entities.[165] Whether organized as a partnership,[166] business trust,[167] zero-member LLC,[168] or some other entity enabled by new state legislation,[169] such organizations assume certain rights and responsibilities, including certain expectations for

160. "[H]acking just means building something quickly or testing the boundaries of what can be done." Pollman, *supra* note 157, at 6 (quoting Facebook, Inc., Registration Statement (Form S-1) 69 (Feb. 1, 2012) (letter from Mark Zuckerberg)).

161. In other words, this Article envisions a form of blockchain governance that leverages contract law to build personalized governance systems for each community. Doing so may enable new lines of investigation into personalized law. *See generally* Caryn Devins et al., *The Law and Big Data*, 27 CORNELL J.L. & PUB. POL'Y 357 (2017); Philipp Hacker, *Personalizing EU Private Law: From Disclosures to Nudges and Mandates*, 25 EUR. REV. PRIV. L. 651 (2017).

162. A functional equivalent, as discussed in comparative legal methodology, is another institution, "legal or non-legal, that perform[s] the same function" as the institution under study (here, a corporation) in order to address the same societal problem differently. Reyes, *Conceptualizing Cryptolaw*, *supra* note 30, at 416.

163. Reyes, *Rockefeller*, *supra* note 30, at 404–05.

164. *See generally* RITVO ET AL., *supra* note 40; George Dafermos, *Authority in Peer Production: The Emergence of Governance in the FreeBSD Project*, *in* THE BOOK OF PEER PRODUCTION 23 (Johan Söderberg & Maxigas eds., 2014); Fish et al., *supra* note 40.

165. For a discussion on the potential to organize blockchain-based businesses as business trusts, see generally Reyes, *Rockefeller*, *supra* note 30. For a discussion on the potential for using blockchain-based businesses to create zero-member LLCs, see Shawn Bayern, *Of Bitcoins, Independently Wealthy Software, and the Zero-Member LLC*, 108 NW. U. L. REV. ONLINE 257, 267–70 (2014) [hereinafter Bayern, *Of Bitcoins*] and Shawn Bayern, *The Implications of Modern Business-Entity Law for the Regulation of Autonomous Systems*, 19 STAN. TECH. L. REV. 93 (2015) [hereinafter Bayern, *Business-Entity Law for Autonomous Systems*].

166. *See generally* Dirk A. Zetzsche, Ross P. Buckley & Douglas W. Arner, *The Distributed Liability of Distributed Ledgers: Legal Risks of Blockchain*, 2018 U. ILL. L. REV. 1361 (arguing that joint control of distributed ledgers leads to joint liability, as in a partnership).

167. *See generally* Reyes, *Rockefeller*, *supra* note 30.

168. *See generally* Bayern, *Of Bitcoins*, *supra* note 165; Bayern, *Business-Entity Law for Autonomous Systems*, *supra* note 165.

169. Landen, *supra* note 38.

governance.[170] Fifth, corporations have a history of governance crises and an ever-evolving governance paradigm to navigate those crises can be found in corporate governance rules.[171] In other words, blockchain protocols operate as organizations and offer "a new 'institutional governance technology of decentralization.'"[172]

Effectively, as developers build these new institutions, they functionally adopt corporate models and transplant corporate law into the code,[173] making corporate governance rules a natural fit for an off-chain governance model. If we view a blockchain protocol, metaphorically or otherwise, as the very organizational life of a business, we can explore the ways that the protocol community might apply corporate governance concepts to the process of making off-chain decisions about the creation and maintenance of the code base. Exploring the usefulness of corporate governance models for public blockchain governance begins with an inquiry into the basic legal characteristics of corporations. Leading commentators recognize that endowing corporations with five key characteristics—legal personality, limited liability, transferable shares, delegated management, and investor ownership—represents the "principal function of corporate law."[174] First, the law recognizes a corporation as a separate legal person to enable entity shielding—namely, separating business assets from those of individual owners to enable creditor priority and liquidation protection.[175] Second, corporate law provides business owners, the shareholders,[176] limited liability such that business creditors cannot make claims against owners' personal assets, while at the same time protecting business assets from claims of

170. Note that when a blockchain protocol incorporates or otherwise forms another legally recognizable business entity, the law of the jurisdiction of formation may supply certain contractual default terms relevant to governance. This may or may not be beneficial to the community.

171. WILLIAM O. FISHER, CORPORATE GOVERNANCE: OVERVIEW, CASE STUDIES, AND REFORMS 1 (2017) (describing how corporate governance laws were historically enacted following corporate governance crises); Brian R. Cheffins, *The History of Corporate Governance*, *in* THE OXFORD HANDBOOK OF CORPORATE GOVERNANCE 46, 46 (Mike Wright et al. eds., 2013) ("Corporate governance has been with us since the use of the corporate form created the possibility of conflict between investors and managers.").

172. Ying-Ying Hsieh, Jean-Philippe Vergne & Sha Wang, *The Internal and External Governance of Blockchain-Based Organizations: Evidence from Cryptocurrencies*, *in* BITCOIN & BEYOND: CRYPTOCURRENCIES, BLOCKCHAINS, AND GLOBAL GOVERNANCE 48, 48 (Malcolm Campbell-Verduyn ed., 2018) (quoting Trent J. MacDonald et al., Blockchains and the Boundaries of Self-Organized Economies: Predictions for the Future of Banking 5 (Mar. 18, 2016) (unpublished manuscript), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2749514 [https://perma.cc/RVB4-M4UK]).

173. *See generally* Reyes, *Conceptualizing Cryptolaw*, *supra* note 30.

174. John Armour et al., *What Is Corporate Law?*, *in* THE ANATOMY OF CORPORATE LAW: A COMPARATIVE AND FUNCTIONAL APPROACH 1, 1 (3d ed. 2017).

175. *Id.* at 5–7. "Liquidation protection restricts the ability of both firm owners and their personal creditors to force the payout of an owner's share of the firm's net assets." Henry Hansmann, Reinier Kraakman & Richard Squire, *Law and the Rise of the Firm*, 119 HARV. L. REV. 1335, 1338 (2006).

176. Or business trust certificate holders, LLC members, or limited partners.

owners' personal creditors.[177] Third, fully transferable shares enable uninterrupted, perpetual existence of the business without regard to ownership changes over time.[178] Fourth, corporate management generally follows a delegated structure under which the owners elect directors who hold core management authority, but who then (often) elect separate officers to address day-to-day operational issues.[179] Fifth, and finally, owners of the corporation invest in the business and receive in return a right to a (limited) measure of business control and net earnings proportional to that investment.[180]

With the exception of legal personality, public blockchain protocols endogenously fulfill these core functions of corporations. First, with regard to actors operating entirely on-chain, the protocol code itself acts as "a self-enforcing contract that credibly binds and segregates assets."[181] Therefore, a blockchain protocol "has the potential to solve the problems of asset-partitioning and limited liability by means of contract alone."[182] Second, cryptocurrency is fully transferable, enabling the same type of ownership diversification seen in corporations.[183] Further, whether specific cryptocurrency owners maintain their ownership or relinquish it is of little import; the protocol continues to function without regard to individual entrances or exits of owners.[184] Third, management of protocols reflects a similar delegated authority structure to that of corporations. The full node operators[185] retain core managerial decision-making capacity (like a board of directors), but the day-to-day operational decisions about proposed code changes reside with a network of open-source software developers, including the core developers (like employees).[186] As noted above, much is made of the core developers, but core developers do not act alone.[187] Rather, any interested community member can make a code change proposal through the designated process—in Bitcoin, the Bitcoin Improvement Proposal (BIP), and in Ethereum, the Ethereum Improvement Proposal (EIP).[188]

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177. Armour et al., *supra* note 174, at 8–9. "The truly essential aspect of asset partitioning is, in effect, the reverse of limited liability—namely, the shielding of the assets of the entity from claims of the creditors of the entity's owners or managers." Henry Hansmann & Reinier Kraakman, *The Essential Role of Organizational Law*, 110 YALE. L.J. 387, 390 (2000).

178. Armour et al., *supra* note 174, at 10–11. This can be true of business trusts also, but it is more difficult to achieve in an LLC or partnership context.

179. *Id.* at 12–13. The same happens in business trusts.

180. *Id.* at 13. This is the same in business trusts.

181. Usha R. Rodrigues, *Law and the Blockchain*, 104 IOWA L. REV. 679, 692 (2019).

182. *Id.*

183. *See generally* Reyes, *Rockefeller*, *supra* note 30.

184. *Id.*

185. Note that a variety of "nodes" exist. Some nodes are passive users simply interacting with the protocol directly, rather than through a user interface offered by a third party. Others actively contribute to the protocol consensus mechanism. De Filippi & Loveluck, *supra* note 14, at 10. This Article uses the terms "full nodes" and "full node operators" to refer to those nodes that are active participants in the management of the protocol.

186. *See* Haque et al., *supra* note 50, at 152.

187. *See id.* at 159–162.

188. *See id.* at 160, 166; *see also* NARAYANAN ET AL., *supra* note 12, at 73–75.

However, some blockchain protocols differ from corporations in two significant respects. First, when cryptocurrency owners purchase cryptocurrency, some do so for the purpose of making an investment in the protocol for which they will receive a proportionate measure of profit or loss. But not all cryptocurrency holders purchase cryptocurrency for such speculative investment purposes.[189] Rather than reducing the conflicts of interest posed by the separation ownership from control of the enterprise, however, this diversity of "owners" likely heightens conflict of interest concerns. Second, depending upon the consensus mechanism employed by the protocol, cryptocurrency owners do not vote on who should occupy the position of full node operator. Arguably, this exacerbates the conflicts of interest already present in the delegated management structure, as ownership is even further separated from control than in the context of a traditional corporation. Notably, this is often not true of decentralized autonomous organizations operating on top of blockchain protocols, which can reduce the gap between ownership and control, often devolving control back to the owners.[190] It is also possible that different consensus mechanisms may allow a devolution of control back to the owners of public blockchains. For example, a proof of stake consensus mechanism, as used in Dash and as contemplated by Ethereum's Casper, enables consensus by vote of the token owners.[191] All of this remains ripe for further investigation and points toward the importance of preserving blockchain governance mechanisms that can be shaped to reflect the peculiarities of each protocol.

Overall, blockchain protocols and the corporation exhibit a functional equivalence that extends to many of the governance difficulties each type of organization faces. In the corporate context, corporate governance provides the protocol by which the individual actors that make up the corporate entity establish the corporate purpose and the means by which they can pursue that purpose.[192] In other words corporate governance "consists of the institutional structures, legal rules, and best practices that determine which body within the corporation is empowered to make particular decisions, how the members of that body are chosen, and the norms that should guide decision making."[193] Corporate governance mechanisms derive from many sources, including the law.[194] The legal rules that inform corporate governance work fill the gaps left by the principal-agent tension inherent in

189. *See* Reyes, *Rockefeller*, *supra* note 30, at 393.

190. For further consideration of such entities, see generally Carla L. Reyes, Autonomous Business Reality (Jan. 10, 2020) (unpublished manuscript) (on file with author).

191. *Id.*; *see also* De Filippi & Loveluck, *supra* note 14, at 9, 12 (noting that Bitcoin Classic "plans to set up a specific governance structure that is intended to promote more democratic decision-making with regard to code changes, by means of a voting process that will account for the opinions of the broader community of miners, users, and developers").

192. STEPHEN M. BAINBRIDGE, CORPORATE GOVERNANCE AFTER THE FINANCIAL CRISIS 2 (2012).

193. *Id.*

194. *Id.*

diffuse shareholder ownership that relies on a core group of directors to manage corporate activity.[195]

Blockchain protocols resemble corporate organizations with a separation between ownership and control.[196] The owners of the value that powers the blockchain ecosystem are the cryptocurrency owners, most of whom have no control or decision-making power regarding the blockchain protocol.[197] Instead, full node operators choose when to adopt updates to the protocol, even though failure of the protocol or mistakes in its development will impact the value of the cryptocurrency.[198] As with corporations, this separation between ownership and control is a feature of blockchain protocols, not a bug.[199] Few cryptocurrency owners desire to run a full node; they would rather be passive participants in the ecosystem. Like the corporation, however, this separation between ownership and control can lead to a divergence in managerial and owner interests.[200]

A vivid debate regarding the nature and appropriate response to the conflicts of interest created by the corporate form persists in the literature.[201] A complete review of that debate is beyond the scope of this Article.[202] Nevertheless, irrespective of the position in the debate, scholars often agree that corporate governance rules work to address certain asymmetries in economic incentives and information availability within the corporation.[203] In other words, the function of corporate governance, regardless of the strand of literature ascribed to, centers on allowing a group of people to coordinate economic activity in pursuit of profit in the most efficient way possible by

195. *Id.* at 2–3.

196. Again, note that this is not necessarily true of decentralized autonomous organizations and/or smart contracts operating on top of the blockchain protocol, and the degree of separation between ownership and control may vary by consensus mechanism (just as it varies between public and private corporations). *See supra* notes 188–89 and accompanying text.

197. Reyes, *Rockefeller*, *supra* note 30, at 425.

198. NARAYANAN ET AL., *supra* note 12, at 73–75 (describing the technical requirements for changing the Bitcoin blockchain).

199. BAINBRIDGE, *supra* note 192, at 3.

200. *Id.*

201. Stephen M. Bainbridge, *Director Primacy: The Means and Ends of Corporate Governance*, 97 NW. U. L. REV. 547, 547 (2003) ("Since Ronald Coase's famous article *The Nature of the Firm* appeared over six decades ago, both economists and legal scholars have devoted considerable attention to the theory of the firm. Over time, this body of work generated a substantial literature providing both positive and normative insights into, inter alia, the internal governance institutions of firms." (footnotes omitted)). As is evident by my inclusion of the principal-agent and team production models, I have considered the scope of the relevant literature broadly to include both corporate law literature and law and economics literature.

202. For more in-depth review of the totality of the debate in the literature, see, for example, Belinfanti & Stout, *supra* note 31, at 586–96.

203. ALFRED D. CHANDLER, JR., THE VISIBLE HAND: THE MANAGERIAL REVOLUTION IN AMERICAN BUSINESS 286 (1977) ("The internalizing of [the many transactions and processes involved in making and selling a line of products] reduced transaction and information costs.").

reducing the number and severity of conflicting interests among corporate actors.[204]

For example, those adhering to the "principal-agent" model point out the need to reduce agency costs by restraining management's action to the confines of shareholders' interests.[205] The "team production" approach, on the other hand, explains corporate law as the mediator among unrelated persons attempting to coordinate productive effort for a profit.[206] In this conception, corporate law mediates attempts to shirk responsibility for the team's production and provides disincentives for those who waste resources by arguing over profit allocation from the team's work.[207] A third model views the firm as a nexus of contracts.[208] In this view, the firm reduces transaction costs and resolves incomplete contracts by acting as a centralized contracting party that can unilaterally alter the terms of the contracts constituting the firm by fiat.[209] Other theories of the nature and purpose of business organizations abound.[210] The asymmetries addressed by each of these various theories of the firm result from: the lack of transparency regarding the actions of significant numbers of actors, some of whom are unknown to each other;[211] the inability of the parties to sufficiently contract

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204. *See* Margaret M. Blair & Lynn A. Stout, *Trust, Trustworthiness, and the Behavioral Foundations of Corporate Law*, 149 U. PA. L. REV. 1735, 1737 (2001) ("Contemporary legal scholarship generally assumes that shareholders, creditors, managers, and employees cooperate with each other because the market and the law give them incentives to do so. In accord with conventional economic analysis, these parties are presumed to be rational actors concerned only with maximizing their own gains. Thus, the primary factors thought to discourage corporate participants from stealing, shirking their duties, or otherwise mistreating each other are market incentives and legal rules, including contract rules.").

205. Zohar Goshen & Richard Squire, *Principal Costs: A New Theory for Corporate Law and Governance*, 117 COLUM. L. REV. 767, 769 (2017) ("Agency costs result from the separation of control and ownership that occurs when managers run a firm but must share its profits with equity holders. Such managers face incentives to expend less effort and consume more perquisites than they would if they were the firm's sole owners. By shirking their duties and diverting value, managers generate agency costs, which reduce their firm's value. Many scholars—we refer to them as *agency-cost essentialists*—treat the reduction of agency costs as the essential function of corporate law and related fields such as securities regulation." (footnotes omitted)).

206. Margaret M. Blair & Lynn A. Stout, *A Team Production Theory of Corporate Law*, 85 VA. L. REV. 247, 249 (1999).

207. *Id.* at 249–51.

208. *See, e.g.*, Frank H. Easterbrook & Daniel R. Fischel, *The Corporate Contract*, 89 COLUM. L. REV. 1416 (1989); Thomas S. Ulen, *The Coasean Firm in Law and Economics*, 18 J. CORP. L. 301, 318–28 (1993).

209. BAINBRIDGE, *supra* note 192, at 555–56.

210. A complete review of all theories of the nature and purpose of the corporation is beyond the scope of this Article. Others include viewing a corporation as an entity, an aggregate of natural persons, the property of its shareholders, and a political system or "franchise government." Lynn Stout, *The Economic Nature of the Corporation*, *in* 2 THE OXFORD HANDBOOK OF LAW AND ECONOMICS: PRIVATE AND COMMERCIAL LAW 337, 343 (Francesco Parisi ed., 2017).

211. Henry N. Butler, *The Contractual Theory of the Corporation*, 11 GEO. MASON U. L. REV. 99, 103 (1989) ("The emergence of firm organization, as well as the particular organizational structure adopted, has been explained as an effort to solve the shirking-monitoring problem of joint production.").

for all variables that will arise over the course of a long-term economic relationship;[212] the rational apathy of shareholders which leads them to accept information asymmetries;[213] and the cost of overcoming these collective action problems.[214]

Blockchain protocol governance reflects many of these same conflicts of interest for many of the same reasons. For instance, when it comes to resolving contracting inefficiencies in the context of long-term relationships, corporate law, together with contract law, usually relies on the gap-filling function of law.[215] When viewed in the context of the entire ecosystem that enables them to operate, blockchain protocols also suffer from gaps—namely, they require further decisions regarding software maintenance and updates in order to accommodate the activities of external actors on the network.[216] Protocols generally rely on their off-chain governance processes to fill those gaps.[217] Corporations do the same thing with governance mechanisms built on top of legal gap-fillers from corporate law.[218] This suggests that corporate governance models may enable a more endogenous governance model for blockchains than other legal regimes that governments might seek to impose in the absence of any clearly identifiable system. If public blockchain protocols and their creators hope to retain the decentralization of their ecosystems without eventually being forced to succumb to an ill-fitting regime imposed from the outside, participants in public blockchain ecosystems should consider voluntarily adopting a contractual governance mechanism inspired by corporate governance but tailored to the values, goals, and ethos of their community.[219]

The proposal offered in this Article helps blockchain governance guard against each of the four forms of capture that Zamfir outlines as harmful potential future visions of blockchain governance.[220] By creating a voluntary operating agreement for blockchain protocols, every participant retains individual agency in blockchain governance, rather than being captured by a single corporation. By modeling the contract on corporate governance structures, blockchain communities may combat the persistent perception

212. Blair & Stout, *supra* note 206, at 259 ("A second interesting organizational problem arises when parties deal with each other over the course of a long-term productive relationship. Writing 'complete' contracts that explicitly provide for all contingencies can often be costly or even impossible.").

213. BAINBRIDGE, *supra* note 192, at 558.

214. KENNETH J. ARROW, THE LIMITS OF ORGANIZATION 68–69 (1974).

215. Rodrigues, *supra* note 181, at 687.

216. NARAYANAN ET AL., *supra* note 12, at 170–75.

217. *See* De Filippi & Loveluck, *supra* note 14, at 8.

218. Oliver E. Williamson, *The Theory of the Firm as Governance Structure: From Choice to Contract*, 16 J. ECON. PERSP. 171, 191 (2002). *See generally* Rodrigues, *supra* note 181.

219. That blockchain protocol communities voluntarily adopt such governance mechanisms is also important from a policy perspective. Efforts by outsiders to impose controls focused on an intended outcome will invariably have unintended effects because the participants in the firm (here, the blockchain protocol ecosystem) "are not passive control agents." Williamson, *supra* note 218, at 174.

220. *See generally* Zamfir, *supra* note 67.

that blockchain protocols are a "Wild West" in need of further regulation.[221] Delineating the role of core developers via contract will enable blockchain communities to limit their role and offer a transparent and concrete source of legitimacy for blockchain governance. Finally, corporate governance itself seeks to limit a cartel of participants in the corporation from hijacking the enterprise for ends other than those in the best interests of the shareholders.[222] A contractual governance mechanism modeled after corporate governance will guard against cartel capture in the blockchain context as well. In the world of actual corporate governance, however, mandatory rules imposed as part of the incorporation process would impede flexibility.[223] Thus, this proposal, styled (un)corporate crypto-governance, might best be thought of as most closely aligning with the Delaware approach to statutory business trusts. The point is to combine the elements of governance used for corporate forms (defined broadly)[224] with those that most closely approximate the functions of blockchain governance to guard against conflicts of interest, maintain community legitimacy, and provide an alternative to ill-fitting laws that governments might consider imposing unilaterally.

III. (UN)CORPORATE CRYPTO-GOVERNANCE

Under a widely, although not universally,[225] accepted definition of the concept, corporate governance "refers to the structure of rights and responsibilities of the different stakeholders and its consequences for the process by which companies are controlled and operated."[226] One of the key issues for corporate governance is ensuring that "executives respect the rights and interests of company stakeholders, as well as guaranteeing that stakeholders act responsibly with regard to the generation, protection, and distribution of wealth invested in the firm."[227] In light of the conflicts of interest that can plague blockchain governance with very similar types of assets at stake, the corporate governance laws that constrain this principal-

221. Note that activity conducted via blockchain, just like activity conducted via the internet, is already heavily regulated. *See* Carla L. Reyes, *Moving Beyond Bitcoin to an Endogenous Theory of Decentralized Ledger Technology Regulation: An Initial Proposal*, 61 VILL. L. REV. 191, 202–11 (2016) (detailing the complex regulatory scheme applicable to activity conducted via blockchain technology). This Article does not intend to suggest that contractual governance of blockchain protocols will replace such regulation. All existing laws would, of course, continue to apply to activity conducted via blockchain technology. Rather, this proposal relates solely to governing how the community manages the protocol while mitigating conflicts of interest.

222. *See, e.g.*, Blair & Stout, *supra* note 204, at 1769.

223. Hansmann et al., *supra* note 42, at 8–9.

224. *Id.*

225. Some scholars point out that "corporate governance is a contested concept, and there is no commonly agreed definition of the term." Annie Pye, *Boards and Governance: 25 Years of Qualitative Research with Directors of FTSE Companies*, *in* THE OXFORD HANDBOOK OF CORPORATE GOVERNANCE, *supra* note 171, at 135, 142.

226. Ruth V. Aguilera et al., *Regulation and Comparative Corporate Governance*, *in* THE OXFORD HANDBOOK OF CORPORATE GOVERNANCE, *supra* note 171, at 23, 23.

227. *Id.*

owner problem in corporations[228] offer powerful tools for doing the same in blockchain protocols. The key types of corporate governance roles recognized by state and federal laws[229] include fiduciaries[230] and gatekeepers.[231] Corporate governance also relies heavily on disclosure mechanisms to reduce information asymmetries between managers and owners. This Part maps these key governance paradigms to various actors in blockchain ecosystems. In so doing, this Part further explores the potential for governance paradigms to alleviate some of the key conflicts of interest currently encountered in off-chain governance paradigms.

A. Full Node Operators as Core Blockchain Protocol Fiduciaries

In August 2016, Professor Angela Walch initiated a fascinating discussion with an *American Banker* article arguing that the open-source software coders and miners of open-source blockchain protocols should be treated as fiduciaries.[232] Generally, law imposes fiduciary duties "when a person undertakes to perform a service effectively and takes property, or accepts power solely for that purpose."[233] The duties imposed include "both a duty

228. Corporate governance has long focused on the divergence of interests between principals and agents, known as the principal-agent problem. *Id.* at 25. "The key idea is that unmonitored managers will pursue goals that are not in the interests of shareholders—ranging from actions that allow them to profit personally (embezzlement, misappropriations) to empire building (hubris)." *Id.*

229. Many of the existing federal corporate governance statutes in the United States materialized in the wake of corporate scandals resulting from high-profile governance crises. BAINBRIDGE, *supra* note 192, at 1 ("The economic crises of the last decade prompted two sweeping federal statutes affecting corporate governance. In response to the scandals that followed in the wake of the dotcom bubble, Congress passed the Public Company Accounting Reform and Investor Protection Act of 2002 . . . . At the end of the decade, when the economy suffered through an even worse downturn following the bursting of the housing bubble and the subprime mortgage crisis, populist outrage motivated Congress to pass the Wall Street Reform and Consumer Protection Act of 2010 (Dodd-Frank)."). These generally apply to publicly traded companies. *Id.* Given the freely transferable nature of cryptocurrencies native to public blockchain protocols, this Article explores whether the rules applicable to public companies have value for public blockchain governance, in addition to the state rules which traditionally apply to corporate governance. Note that, traditionally, state law supplied corporate governance rules through their corporate statutes. *Id.* at 2. State rules, in addition to governing private companies, continue to apply to publicly traded companies, even after the enactment of additional federal rules. *Id.* at 21.

230. *Id.* at 43 ("The most basic principle of corporate governance is, as the Delaware General Corporation Law puts it, that the corporation's business and affairs 'shall be managed by or under the direction of a board of directors.'" (quoting DEL. CODE ANN. tit. 8, § 141(a))).

231. Elisabeth de Fontenay, *Private Equity Firms as Gatekeepers*, 136 REV. BANKING & FIN. L. 115, 136 (2013) ("Gatekeepers are broadly understood to be private actors that can prevent companies' misconduct in a specific market.").

232. Walch, *Call Blockchain Developers What They Are*, *supra* note 21.

233. Tamar Frankel, *Fiduciary Duties as Default Rules*, 74 OR. L. REV. 1209, 1223 (1995). "Fiduciary law is triggered merely by the fiduciary's consent to provide services, coupled with entrustment." *Id.* at 1224; *see also* Julian Velasco, *Delimiting Fiduciary Status*, *in* RESEARCH HANDBOOK ON FIDUCIARY LAW 76, 82 (D. Gordon Smith & Andrew S. Gold eds., 2018) ("A fiduciary relationship is one in which one party (the fiduciary) exercises discretionary power over the significant practical interests of another (the beneficiary)." (quoting Paul B. Miller, *A Theory of Fiduciary Liability*, 56 MCGILL L.J. 235, 262 (2011) (emphasis omitted))).

of care—to act carefully and not negligently—and a duty of loyalty—to perform their services in the interest of their entrustors and not in conflict of interest."[234] Those that considered the idea after Professor Walch struggled to identify an existing source of law that would impose fiduciary duties on either software developers or miners.[235] In her deeper investigation of the issue, Professor Walch acknowledges that, although she continues to believe that coders and miners arguably possess some of the core characteristics of fiduciaries, she has not yet identified the basis for assigning fiduciary legal duties, to whom duties are owed, what duties are owed, how to identify a breach, or what consequences of breach would result.[236]

Ultimately, Professor Walch concludes that the right approach requires "focus[ing] on the behaviours of software developers in the public blockchain context."[237] In other words, the analysis of whether to treat certain actors in the blockchain ecosystem as fiduciaries cries out for a functional approach. As discussed above, blockchain protocols act, in many ways, as the functional equivalents of corporations. Viewing public blockchain protocols as corporate functional equivalents allows us to draw boundaries around which actors in the blockchain ecosystem may shoulder fiduciary obligations and to whom those obligations are owed. In particular, although the discussion around whether open-source software developers should be fiduciaries centered on blockchain core developers until now, there seems to be no principled reason to limit the "coders-as-fiduciary" liability to the blockchain context (or even just to core developers as opposed to all open-source code developers).[238] Thus, taken to its logical conclusion, the "coders-as-fiduciary" argument could apply to open-source software developers contributing to the Internet Protocol, Linux, Apache, and any other open-source software development effort. This would represent an unprecedented change in the legal approach to governing these communities. It also ignores the realities of the governance systems of many open-source software development efforts.[239]

Despite the general definition of a fiduciary relationship existing whenever an entrustor trusts another person with the management of assets,[240] under the jurisprudential principle of *lex specialis*, when "the fiduciary relationship arises in conjunction with another legal relationship, the bargain concerning these functions and entrusted powers is governed initially by the law

234. Frankel, *supra* note 233, at 1210.

235. Judith Alison Lee, *Blockchain Technology and Legal Implications of 'Crypto 2.0,'* 104 Banking Rep. (BNA) 13, at 67 (Mar. 31, 2015).

236. Walch, *In Code(rs) We Trust*, *supra* note 21, at 71–76.

237. *Id.* at 77.

238. For example, in her work, Angela Walch does not propose any limiting principle that would prevent application of her "coder-as-fiduciary" idea from going beyond the blockchain context to all other open-source projects. *See generally* Walch, *In Code(rs) We Trust*, *supra* note 21.

239. For a more detailed discussion of why the realities of open-source software development do not comport well with the theory of "coder-as-fiduciary," see generally Haque et al., *supra* note 50.

240. *See supra* notes 231–32 and accompanying text.

governing that legal relationship."[241] For example, the Model Business Corporation Act and the Delaware Corporation Act draw boundaries around which actors in a corporation owe fiduciary duties and under what circumstances.[242] Those carrying out the function of a director or majority shareholder (under certain circumstances) owe fiduciary obligations, and those obligations are owed to the corporation and its shareholders.[243] Furthermore, corporations remain free, to a certain extent, to shape the scope of liability for potential breaches of fiduciary duties via contract in the entity's governing documents.[244] The relative strength or weakness of fiduciary duties in a given corporate governance structure reflects certain values related to the nature and purpose of a corporation.[245] The more strongly held the view that the corporation is a nexus of contracts, the weaker the belief in strong fiduciary duties.[246] Similarly, when owners of a company want an expert group of managers strongly enough, they may be willing to forgo a stronger level of protection and opt instead for weaker fiduciary duties.[247] Typically, state governments make such policy decisions and reflect them in default and mandatory statutory rules. Even this basic governance paradigm offers important lessons for blockchain protocol governance.[248] Specifically, a design trade-off exists between protecting users by imposing fiduciary duties on node operators and maintaining the

241. Frankel, *supra* note 233, at 1233.

242. *See, e.g.*, DEL. CODE ANN. tit. 8, §§ 102(b)(7), 141 (2020); MODEL BUS. CORP. ACT §§ 2.02(b)(4), 8.30, 8.31 (AM. BAR ASS'N 2016); *see also* Tamar Frankel, *Fiduciary Law*, 71 CALIF. L. REV. 795, 795–96 (1983) ("In the business realm, the fiduciary duties of partners, corporate directors, and officers originated with the formation of partnerships and corporations, but majority shareholders were not subjected to fiduciary duties until this century."). Under the law of business trusts, the trustees owe fiduciary duties to the trust's certificate holders in the same way that directors owe fiduciary duties to a corporation's shareholders. *See* John H. Langbein, *The Secret Life of the Trust: The Trust as an Instrument of Commerce*, 107 YALE L.J. 165, 182 (1997) (noting that the business trust form "automatically invokes the distinctive protective regime of trust fiduciary law for safeguarding the interests of investors or other beneficiaries").

243. D. Gordon Smith & Andrew S. Gold, *Introduction* to RESEARCH HANDBOOK ON FIDUCIARY LAW, *supra* note 233, at 1, 1 ("Trustees are fiduciaries for the beneficiaries of the trust. People with managerial power in a business organization—partners, officers, directors, and so forth—are fiduciaries for the owners of the business organization."); Christopher M. Bruner, *Opting Out of Fiduciary Duties and Liabilities in U.S. and U.K. Business Entities*, *in* RESEARCH HANDBOOK ON FIDUCIARY LAW, *supra* note 233, at 285, 287 ("In Delaware, fiduciary duties of loyalty and care are owed by directors, officers, and controlling shareholders 'to the corporation and its stockholders.'" (quoting Guth v. Loft, Inc., 5 A.2d 503, 510 (Del. 1939))).

244. *See* Bruner, *supra* note 243, at 288–89 ("While the duties themselves are cabined only in [a few] limited respects, the [Delaware General Corporation Law] and case law do provide substantial leeway to carve back at fiduciaries' exposure to monetary liability for care breaches—an approach reflecting a pragmatic desire to incentivize entrepreneurial risk-taking. . . . The [Model Business Corporation Act] likewise resembles Delaware in providing substantial latitude to limit or eliminate monetary liability for care breaches.").

245. Rodrigues, *supra* note 181, at 10–12.

246. *See* Bruner, *supra* note 243, at 302.

247. *See id.*

248. Rodrigues, *supra* note 181, at 10–16.

level of unfettered discretion left to node operators.[249] The exercise of crafting a corporate crypto-governance contract between participants in a blockchain ecosystem will force a transparent discussion about such trade-offs. Such transparency and discussion, standing alone, offer some benefits of adopting an (un)corporate crypto-governance model.

Notably, many open-source software development projects recognize the power imbalances in their ecosystems and create contractual codes of conduct and organizational bylaws that look quite similar to corporate governing documents.[250] In fact, some blockchain ecosystems are already forming governance structures modeled on corporate governance and their open-source predecessors.[251] As elaborated upon more fully below, a detailed mapping of blockchain participants to corporate governance actors reveals that public blockchain protocols should consider contractually assigning full nodes participating in the consensus mechanism of blockchain protocols (for example, miners in the Bitcoin blockchain or masternode operators in the Dash protocol)[252] the responsibilities of core protocol fiduciaries that owe duties to cryptocurrency holders. Conversely, such a model would point to restraint in assigning fiduciary duties to the developers of blockchain protocol open-source code, including the core developers, except under certain exceptional circumstances.[253]

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249. Alan Z. Rozenshtein, *Surveillance Intermediaries*, 70 STAN. L. REV. 99, 164 (2018) ("The tradeoff thesis . . . applies more generally to any situation in which we're trying to maximize a set of values, at least some of the time.").

250. *See generally* RITVO ET AL., *supra* note 40; Dafermos, *supra* note 164; Fish et al., *supra* note 40.

251. *See, e.g.*, *Governance Guidelines*, *supra* note 39.

252. For an explanation of how this Article uses the term "full node operators" and why, see *supra* note 63.

253. In "If Rockefeller Were a Coder," I argued that decentralized business organizations, including blockchain protocols themselves, should consider organizing as business trusts in order to escape the default penalty (personal liability) imposed on partnerships. *See generally* Reyes, *Rockefeller*, *supra* note 30. The discussion here regarding corporate governance fits the business trust model as well. The trustee holders of tokens would owe fiduciary duties to the certificate holders of tokens. Business trust law relies on the same trust fiduciary law that applies in the donative trust context. Tamar Frankel, *The Delaware Business Trust Act Failure as the New Corporate Law*, 23 CARDOZO L. REV. 325, 335 (2001) ("If a corporation manages other people's money and performs Trust Services, it is regulated as a trust, and its duties to the beneficiaries are trustees' duties."); Langbein, *supra* note 242, at 182 ("Another trait of the trust form that is of fundamental importance to transaction planers is that the trust automatically invokes the distinctive protective regime of trust fiduciary law for safeguarding the interests of investors or other beneficiaries."). *See generally In re* Dean's Tr., 394 P.2d 432 (Haw. 1964); Flynn v. La Salle Nat'l Bank, 137 N.E.2d 71 (Ill. 1956); Wallace v. Malooly, 122 N.E.2d 275 (Ill. 1954). Also note that at least one court found that holders of certificates of beneficial ownership in trusts do not owe fiduciary duties to each other. Krensky v. De Swarte, 82 N.E.2d 168 (Ill. App. Ct. 1948). As a result, the fiduciary regime applicable to business trusts resembles that of corporations—with trustees as directors and certificate holders as shareholders. Langbein, *supra* note 242, at 182 (calling the duties "loyalty and prudence"). The duty of loyalty ensures the trustees will operate the trust "solely in the interest of the beneficiaries." *Id.* (quoting RESTATEMENT (SECOND) OF TRS. § 170(1) (AM. LAW INST. 1957)). As in the corporate context, this means that trustees must refrain from self-dealing and conflict-of-interest transactions. *Id.* Trustees also owe a duty of care to trust certificate holders, meaning that the trustee owes "a duty to the beneficiary in administering the trust to

Directors hold the positions of core fiduciaries in the corporate context.[254] As a result of the discretion they wield when managing the business, directors owe duties of care and loyalty to the owners of the company—the shareholders.[255] When we map these functions of directors to the players in a public blockchain protocol, core developers and open-source software contributors do not serve the same function as directors—rather, full node operators do. As a result, the corporate governance model does not provide support for imposing fiduciary obligations on the developers of the open-source computer code that comprises the blockchain protocol.[256] At no point do the developers of open-source computer code assume the role of a director in a corporation, unless they otherwise participate in the protocol as a node operator or hold a significant amount of the protocol's native cryptocurrency. This result reflects the policy aims of fiduciary law, the main purpose of which "is to reduce entrustors' risk from embezzlement of their entrusted property or interests, and to reduce the costs of monitoring fiduciaries."[257] At no point do cryptocurrency owners entrust assets to open-source software

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exercise such care and skill as a man of ordinary prudence would exercise in dealing with his own property." *Id.* (quoting RESTATEMENT (SECOND) OF TRS. § 174 (AM. LAW INST. 1957)). The fiduciary trust obligations are default rules that parties can change through contract, although some state statutes may impose minimum requirements. *See id.* at 183–85. I also argued that smart contracts could be business trusts. The (un)corporate crypto-governance model applies to a distributed business entity (DBE) at the smart contract level as well, for the most part. Smart contracts that fulfill the role of trustees owe holders smart contract tokens fiduciary duties under the DBE model. Two characteristics of fiduciaries generally, and of trustees specifically, involve the substitution role of the fiduciary and the delegation of power to the fiduciary. Frankel, *supra* note 242, at 808–09. The fiduciary acts as a substitute for the entrustor and the entrustor delegates to the fiduciary the power required for the fiduciary to do so efficiently. *Id.* In the context of smart contract DBEs, the entrustors delegate to the smart contract the power to control certain assets and expect the smart contract to act as a substitute for the entrustors in using those assets for the creation of profit. Of the three levels of DBEs, the smart contract poses unique questions for the issue of fiduciary obligations. Setting aside those questions for now, the point here is that the model of (un)corporate crypto-governance outlined in this Article holds promise and implications for business entities conducted at any level of the blockchain technology stack. However, the implications for business entities at other levels of the technology stack deserve further investigation and research, particularly because, as noted above, they often devolve control back to the owners of the enterprise in ways that many prominent blockchain protocols have not yet achieved via off-chain governance. *See generally* Reyes, *supra* note 190.

254. Smith & Gold, *supra* note 243, at 7 ("Directors manage the business and affairs of the corporation. This management role necessarily entails the exercise of discretion, which is widely recognized as an essential aspect of fiduciary relationships.").

255. *Id.*; *see also* Bruner, *supra* note 243, at 287.

256. Notably, to the extent that the concern underlying the push to recognize open-source software developers as fiduciaries lies in holding coders accountable for negligent coding that results in a bug in the protocol, fiduciary law is unnecessary. All individuals face liability for torts they commit. RESTATEMENT (THIRD) OF AGENCY § 7.01 (AM. LAW INST. 2005). Any perceived failure of tort law to address such scenarios should be treated within that substantive legal domain, and a whole other line of scholarly literature investigates those issues. *See, e.g.*, Bryan H. Choi, *Crashworthy Code*, 94 WASH. L. REV. 39 (2019); Bryan H. Choi, *Software as a Profession*, 33 HARV. J.L. & TECH. (forthcoming 2020).

257. Frankel, *supra* note 233, at 1223.

developers. Rather, cryptocurrency owners entrust their assets to the blockchain protocol's full node operators.[258]

While the literature confirms that certain open-source software developers possess significant influence in a blockchain ecosystem,[259] those developers have no power, standing alone, to dispose of, embezzle, or otherwise impact the use of entrustors' assets. For example, the Bitcoin blockchain's core development team possesses significant influence over the trajectory of that protocol's code.[260] Specifically, although technical improvements to the Bitcoin core software occur through "pull requests" and can be contributed by anyone,[261] more substantial changes to the Bitcoin blockchain occur through the BIP process.[262] Although anyone may suggest a BIP and such BIPs must be made available for review by the broader open-source community,[263] the core developers ultimately make the final decision as to whether to introduce a BIP to the protocol.[264] Nevertheless, any attempt to introduce a BIP to the protocol as a software update must be approved by a majority of the node operators, and an update the broader community disagrees with may be rejected.[265] Because the full node operators alone hold this power to adopt updates to the protocol software, they alone have the ability to manage the core asset of the enterprise: the blockchain

258. NARAYANAN ET AL., *supra* note 12, at 104–05 (listing the tasks of bitcoin miners as listening for transactions, maintaining blockchain and listening for new blocks, assembling a candidate block, finding a nonce that makes your block valid, hoping your block is accepted, and profiting).

259. De Filippi & Loveluck, *supra* note 14, at 18.

260. *Id.* ("[W]hile anyone is entitled to submit changes to the software (such as bug fixes, incremental improvements, etc.), only a small number of individuals (the core developers) have the power to decide which changes shall be incorporated into the main branch of the software."). *But see* NARAYANAN ET AL., *supra* note 12, at 171 ("How powerful are these people? In one sense, they're very powerful, because you could argue that any of the rule changes to the code that they make will get shipped in Bitcoin Core and will be followed by default. . . . In another sense, they're not powerful at all. Because it's open-source software, anyone can copy and modify it (i.e., fork the software at any time), and so if the lead developers start behaving in a way that the community doesn't like, the community can go in a different direction.").

261. NARAYANAN ET AL., *supra* note 12, at 170 ("Anyone can contribute technical improvements via 'pull requests' to Bitcoin Core, a familiar process in the world of open-source software. More substantial changes, especially protocol modifications, use a process called 'Bitcoin Improvement Proposals' (BIPs).").

262. "A BIP is a design document providing information to the Bitcoin community, or describing a new feature for Bitcoin or its processes or environment. The BIP should provide a concise technical specification of the feature and a rationale for the feature." De Filippi & Loveluck, *supra* note 14, at 19 n.30.

263. *Id.* at 19.

264. *Id.*

265. *Id.* at 19–20 ("Yet, ultimately, the sovereignty of the overall project rests with *the people*—i.e. the Bitcoin users and miners. If the core developers were to make a modification to the code that the community disagrees with (the miners, in particular), the community might simply refuse to run the new code."); *see also* NARAYANAN ET AL., *supra* note 12, at 171 ("Because it's open source software, anyone can copy and modify it (i.e., fork the software at any time), and so if the lead developers start behaving in a way that the community doesn't like, the community can go in a different direction.").

protocol.[266] Only the full node operators hold the power to make updates to the blockchain protocol to which users have entrusted their value. The final decision of the node operators, not the recommendations of the core developers, ultimately impact the value of cryptocurrency held by users.[267] As a result, full node operators most closely approximate the role of corporate directors[268] and therefore represent the more likely candidates for assigning fiduciary duties in public blockchain protocols.

As fiduciaries under a contractually adopted corporate governance model, the full node operators would agree to owe duties of care and loyalty to the holders of the cryptocurrency used on the protocol.[269] Members of the community would set the level of responsibility they deem appropriate via contract, with the general goals of constraining self-interested votes on BIPs, EIPs,[270] and other protocol updates;[271] offering increased disincentives for launching a 51 percent or other node attack;[272] and providing a shield against undue influence from members of the core developer community. In particular, the duty of care would require that full node operators make decisions about protocol consensus and protocol changes in a reasonable manner and in the best interests of the protocol.[273] Transplanting this

266. In the Bitcoin blockchain, for example, miners decide "[w]hich transactions to include," "[w]hich block to mine on," how to choose "between blocks at the same height," and "[w]hen to announce new blocks." NARAYANAN ET AL., *supra* note 12, at 131. And these decisions are required simply to confirm new transactions occurring on the network. *Id.* In addition, miners in the Bitcoin blockchain decide when to adopt changes to the protocol. *See id.* at 73–74 (describing the processes for implementing changes to the protocol via soft and hard forks).

267. *See id.*

268. Or trustees in a business trust. *See* Reyes, *Rockefeller*, *supra* note 30.

269. *See* Bruner, *supra* note 243, at 287. There is some discussion in the literature as to whether the duty of care is actually a fiduciary duty. *See, e.g.*, Christopher M. Bruner, *Is the Corporate Director's Duty of Care a 'Fiduciary' Duty?: Does it Matter?*, 48 WAKE FOREST L. REV. 1027, 1033–36 (2013). Nevertheless, U.S. jurisprudence predominately continues to consider the duties of care and loyalty to both be fiduciary duties. *Id.* at 1039–51.

270. *EIPs*, ETHEREUM IMPROVEMENT PROPOSALS, https://eips.ethereum.org/ [https://perma.cc/Y526-839R] (last visited Mar. 17, 2020) ("Ethereum Improvement Proposals (EIPs) describe standards for the Ethereum platform, including core protocol specifications, client APIs, and contract standards.").

271. Other protocols call these proposals something else and have other processes for considering them. *See, e.g.*, *Dash Improvement Proposals (DIPs)*, GITHUB, https://github.com/dashpay/dips [https://perma.cc/UV2D-2RGH] (last visited Mar. 17, 2020); *NEP Repo #7*, GITHUB, https://github.com/namecoin/meta/issues/7 [https://perma.cc/XZS9-8EYH] (last visited Mar. 17, 2020). In fact, the Internet Protocol boasts a similar process. NARAYANAN ET AL., *supra* note 12, at 174 ("[T]he BIP process is reminiscent of the RFC, or Request for Comments, which is a type of standards-setting document for the Internet.").

272. Although the 51 percent attack attracts the most media attention, a variety of potential node attacks could occur. *See, e.g.*, NARAYANAN ET AL., *supra* note 12, at 130–36 (describing a variety of attacks that could be perpetrated by miners); *id.* at 204–05 (describing block-discarding attacks); *id.* at 210 (describing forking attacks).

273. *See* D. GORDON SMITH & CYNTHIA A. WILLIAMS, BUSINESS ORGANIZATIONS: CASES, PROBLEMS, AND CASE STUDIES 362 (3d ed. 2012); *see also* Francis v. United Jersey Bank, 432 A.2d 814, 820 (N.J. 1981) (stating that a director must "discharge their duties in good faith and with [the] degree of diligence, care and skill which ordinarily prudent men would exercise under similar circumstances in like positions").

requirement from corporate law might require full node operators to become sufficiently educated about the proposal before making a decision,[274] undertake an investigation of the proposal and its expected effect on the protocol,[275] independently test the proposed code,[276] and ensure that the vote was not otherwise undertaken for bad faith purposes.[277] Fulfilling such duties may require full node operators to undertake relatively significant activities before committing to an updated version of the software. For example, courts read into the requirement to be informed an expectation that the decision maker gather outside information, consult with experts, and consider relevant test data when appropriate.[278]

Furthermore, in the corporate context, the duty of loyalty requires that directors "affirmatively . . . protect the interests of the corporation committed to [its] charge, [and] refrain from doing anything that would work injury to the corporation, or to deprive it of profit or advantage which its skill and ability might properly bring to it."[279] This duty generally boils down to requirements that directors refrain from engaging in undisclosed and unapproved self-dealing transactions[280] and taking opportunities that belong to the corporation for personal benefit.[281] The duty of loyalty in the blockchain protocol context will look slightly different than in the corporate context but nevertheless offers a helpful restraint on the diverging interests of cryptocurrency holders and full node operators. For example, overlaying the corporate prohibition on usurping corporate opportunities on the responsibilities of full node operators disincentivizes launching a node attack or engaging in double spending or other dishonest behavior.[282] Those node

274. *See, e.g.*, Smith v. Van Gorkom, 488 A.2d 858, 872 (Del. 1985).

275. *See generally In re* The Walt Disney Co. Derivative Litig., 825 A.2d 275 (Del. Ch. 2003).

276. *See generally Van Gorkom*, 488 A.2d 858.

277. *See generally* Cede & Co. v. Technicolor, Inc., 634 A.2d 345 (Del. 1994); McPadden v. Sidhu, 964 A.2d 1262 (Del. Ch. 2008).

278. *Francis*, 432 A.2d at 823 ("Sometimes a director may be required to seek the advice of counsel. . . . The duty to seek the assistance of counsel can extend to areas other than the interpretation of corporation instruments. Modern corporate practice recognizes that on occasion a director should seek outside advice.").

279. Guth v. Loft, Inc., 5 A.2d 503, 510 (Del. 1939).

280. Sung Hui Kim, *Fiduciary Law's Anti-corruption Norm*, *in* RESEARCH HANDBOOK ON FIDUCIARY LAW, *supra* note 233, at 117, 135 ("Courts have broadly but inconsistently proscribed the fiduciary's use of an entrusted position for self-regarding gain where the fiduciary failed to disclose the gain to [the] beneficiary."); Lionel Smith, *Fiduciary Relationships: Ensuring the Loyal Exercise of Judgement on Behalf of Another*, 130 LAW Q. REV. 608, 609 (2014) (explaining the policy concern underlying the rule as the prevention of self-enrichment at the beneficiary's expense).

281. *Guth*, 5 A.2d. at 511 ("[I]f there is presented to a corporate officer or director a business opportunity which the corporation is financially able to undertake, is, from its nature in the line of the corporation's business and is of practical advantage to it, is one in which the corporation has an interest or a reasonable expectancy, and, by embracing the opportunity, the self-interest of the officer or director will be brought into conflict with that of [the] corporation, the law will not permit him to seize the opportunity for himself.").

282. The threat of a 51 percent attack earned new relevance when Ethereum Classic suffered a suspected successful 51 percent attack that "reorganized" more than one hundred blocks. Nikhilesh De & Christine Kim, *Coinbase Suspends Ethereum Classic After*

operators that financially benefit from participating in a 51 percent or other network attack may be required to disgorge that financial benefit after a successful suit for breach of fiduciary duty of loyalty.[283] Requiring full node operators to refrain from undisclosed and unapproved self-dealing transactions would require that approval of BIPs or other protocol updates be based on their technical merits and that whenever a node operator's personal economic interest might be implicated, that conflict of interest be disclosed.[284] These outcomes may affect the basic motivations for becoming node operators and may change some cultural elements of the blockchain ecosystem.[285]

Some node operators argue that imposing a fiduciary overlay on their activities makes little sense because many node operators do not actively make decisions about protocol consensus.[286] Rather, many node operators merely run the default client settings.[287] However, when updates to the protocol pose some level of controversy, node operators often actively campaign for their preferred position on whether to integrate the update.[288] In such cases, node operators participate in private and public votes on the matter before the upgrade is implemented.[289] Further, recent events indicate that, in certain circumstances, node operators can collude sufficiently to

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Blockchain History Rewrites, COINDESK (Jan. 7, 2019), https://www.coindesk.com/coinbase-suspends-ethereum-classic-after-blockchain-history-rewrites [https://perma.cc/5BQW-MK3V].

283. Smith & Gold, *supra* note 243, at 6 ("Fiduciary law makes use of distinctive remedies, most notably the disgorgement remedy. Disgorgement is only rarely applied in contract settings, yet it is commonly adopted in response to fiduciary disloyalty.").

284. For an example of a protocol upgrade that implicates the financial self-interest of node operators, see the Ethereum Constantinople upgrade. *See* ANDREAS M. ANTONOPOULOS & GAVIN WOOD, MASTERING ETHEREUM: BUILDING SMART CONTRACTS AND DAPPS 5 (2019). Ethereum is moving from a proof-of-work consensus mechanism to a proof-of-stake consensus mechanism:

> The message that is going out in the community is that miners are not ready to switch to [proof of stake]. The protocol, which is fairly more economical than [proof of work], does not require miners to put a massive amount of computational data to keep the network running and secure. Instead, it choses miners to verify transactions based on how much Ether they hold. . . . Also, Constantinople will reduce mining rewards from 3 ETH to 2 ETH in an already difficult market.

Davit Babayan, *Only 16% of Ethereum Nodes Upgrade Before Hard Fork, It's a Nonissue*, NEWS BTC (Jan. 15, 2019), https://www.newsbtc.com/2019/01/15/only-16-of-ethereum-nodes-upgraded-before-hard-fork-its-a-nonissue/ [https://perma.cc/2JRF-D45V].

285. Indeed, society should always expect ripple effects to result from transplanting law into code or code into law. *See* Reyes, *Conceptualizing Cryptolaw*, *supra* note 30, at 428.

286. De Filippi & Loveluck, *supra* note 14, at 10 (noting the passivity of some nodes).

287. *See* NARAYANAN ET AL., *supra* note 12, at 136.

288. Haque et al., *supra* note 50, at 163, 170 (describing user-activated soft forks and flag days and discussing a vote via carbonvote.com regarding the hard fork following the DAO incident as an example of debate and decision-making in protocol communities); *see also* Mike Dalton, *Bitcoin Cash Hard Fork: What You Need to Know*, UNHASHED (Nov. 26, 2018), https://unhashed.com/cryptocurrency-news/bitcoin-cash-hard-fork-what-you-need-to-know/ [https://perma.cc/N5SW-N8DV] (describing the mining factions at work and explaining that, only "[a]fter months of debate and preparation from mining factions, the Bitcoin Cash hard fork finally took place in mid-November").

289. *See* Haque et al., *supra* note 50, at 162–63.

undertake some of the network attacks previously considered merely theoretical.[290] Notably, however, this description of nodes and how they operate does not adequately reflect the diversity of node operators. The reality is that node operators represent a diverse group. Any community contract adopting fiduciary duties for node operators should take that diversity into account when considering the scope of liability for breaches of fiduciary duties.[291] Such contracts should also affirmatively consider the fluid nature of many nodes. Nodes enter and exit the protocol system all the time. The community must decide whether such entrances and exits mean anything for governance and, if so, how to manage those transitions.[292] Such complex realities reaffirm the importance of allowing blockchain communities to privately order their governance affairs rather than imposing a top-down, one-size-fits-all solution. Governance systems based on contract that borrow elements of corporate governance paradigms offer a path forward.

B. Majority Shareholders as Fiduciaries at Key Moments

In the corporate context, controlling shareholders owe fiduciary duties under certain circumstances.[293] In particular, when a controlling shareholder stands on both sides of a transaction, the transaction generally must survive an entire fairness standard.[294] Generally, the law views a shareholder as controlling if the shareholder owns 51 percent or more of the voting shares,[295] if a minority shareholder nonetheless dominates the corporation through actual control of corporate conduct,[296] or if a group of unaffiliated

290. *See* De & Kim, *supra* note 282.

291. This Article does not address the issues of enforcement or dispute resolution in the event of a governance failure under the (un)corporate crypto-governance model. Rather, I reserve that discussion for a future work.

292. Notably, several open-source projects already do this, including several in the blockchain space. *See, e.g.*, *Code of Conduct*, APACHE SOFTWARE FOUND., https://www.apache.org/foundation/policies/conduct.html [https://perma.cc/L6CP-YKRC] (last visited Mar. 17, 2020); *Contributor Covenant Code of Conduct*, LINUX KERNEL, https://www.kernel.org/doc/html/latest/process/code-of-conduct.html [https://perma.cc/Z2UU-YV6V] (last visited Mar. 17, 2020); *Governance Guidelines*, *supra* note 39; Tracy Kuhrt, *Hyperledger Code of* Conduct, HYPERLEDGER (Jan. 22, 2019), https://wiki.hyperledger.org/community/hyperledger-project-code-of-conduct [https://perma.cc/4B5C-U33H];

293. *See, e.g.*, Kahn v. Lynch Commc'n Sys., Inc., 638 A.2d 1110, 1113 (Del. 1994); Ivanhoe Partners v. Newmont Mining Corp., 535 A.2d 1334, 1344 (Del. 1987) (stating that controlling shareholders are company fiduciaries); Weinberger v. UOP, Inc., 457 A.2d 701, 705 (Del. 1983) (stating that a controlling shareholder owed a fiduciary duty to minority shareholders in a cash-out merger).

294. *See generally* Kahn v. M & F Worldwide Corp., 88 A.3d 635 (Del. 2014); *see also* WILLIAM K. SJOSTROM, JR., BUSINESS ORGANIZATIONS: A TRANSACTIONAL APPROACH 519 (2d ed. 2016).

295. Weinstein Enters., Inc. v. Orloff, 870 A.2d 499, 507 (Del. 2005) ("[I]t is well established in the corporate jurisprudence of Delaware that control exists when a stockholder owns, directly or indirectly, more than half of a corporation's voting power.").

296. *In re* W. Nat'l Corp. S'holders Litig., C.A. No. 15927-CC, 2000 WL 710192, at *20 (Del. Ch. May 22, 2000) (holding that a "significant stockholder that does not, as a general matter, exercise actual control over the investee's business and affairs or over the investee's board of directors but does, in fact, exercise actual control over the board of directors during

shareholders creates a group via contract that gives them controlling voting power.[297] When a controlling shareholder thus defined stands on both sides of the transaction, it must demonstrate that the transaction was made entirely fair by implementing systems designed to cleanse the transaction of any self-dealing taint.[298] When transplanted to the blockchain protocol context, these rules surrounding majority shareholders implicate potential duties at key moments for large holders of cryptocurrency, particularly if the significant cryptocurrency ownership is coupled with a unique influence on the blockchain protocol community.

In particular, if a controlling cryptocurrency owner (one that owns 51 percent or more or that owns a significant amount of cryptocurrency and also wields some unique power in the protocol community—for example, by virtue of being a founder or by reputation) recommends a protocol upgrade with the potential to result in personal economic benefit, that proposal might be subject to closer scrutiny along the lines of the entire fairness standard for corporate controlling shareholder transactions. The contract among the protocol governance participants could address the process for entire fairness ratification in several ways. A standing committee of independent experts could be formed at the relevant foundation[299] for the purpose of reviewing and opining on the fairness and merits of such proposals. Alternatively, the proposal could be put to a vote of the minority cryptocurrency owners in the ecosystem. If a majority of them approve the transaction on an informed basis, then the standard of entire fairness would (roughly) be satisfied. The community could also impose their own standards for determining entire fairness in such situations. The goal in any case would be to inform the entire community of the potential conflict of interest and allow the proposal to be weighed on the merits notwithstanding the conflict. This type of radical transparency mirrors the vision and ethos of many blockchain protocol communities and protects the reputation of the protocol from scrutiny if the community approves and implements the transaction.[300]

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the course of a particular transaction, can assume fiduciary duties for purposes of that transaction").

297. eBay Domestic Holdings, Inc. v. Newmark, 16 A.3d 1, 25–27 (Del. Ch. 2010) (finding that cosigners of a voting trust were controlling fiduciaries because they had enough votes to elect the board).

298. Jonathan Rosenberg & Alexandra Lewis-Reisen, *Controlling-Shareholder Related-Party Transactions Under Delaware Law—a Primer and Practical Guide*, HARV. L. SCH. F. ON CORP. GOVERNANCE & FIN. REG. (Aug. 30, 2017), https://corpgov.law.harvard.edu/2017/08/30/controlling-shareholder-related-party-transactions-under-delaware-law/ [https://perma.cc/7545-URST] (explaining that "there is no single recipe for an 'entirely fair' controlling-shareholder transaction" and offering useful guidelines from case law to achieve entire fairness).

299. For example, the Bitcoin Foundation or the Ethereum Foundation.

300. For example, this type of transparency would have been useful for sustaining legitimacy of governance mechanisms during the DAO hard fork discussion. ANTONOPOULOS & WOOD, *supra* note 284, at 325 (discussing the community disagreement relating to the hard fork implemented after the DAO theft and how strong feelings led many to opt out of the original Ethereum protocol).

C. Core Developers, Founders, and Protocol Foundations as Gatekeepers

Generally speaking, the term "gatekeeper" refers to "private actors that can prevent companies' misconduct in a specific market."[301] Corporate governance literature views the role of "gatekeepers" as reducing the information asymmetry that necessarily plagues the market for corporate securities, but with specific focus on information related to misconduct.[302] Corporations are the sole source of information regarding the value allegedly represented by their stock.[303] Those purchasing corporate shares need a way to reduce incentives for corporations to intentionally defraud the market or carelessly provide misinformation to market participants.[304] To that end, "[a]s a form of bonding the credibility of their disclosures, the company hires various outsiders—such as an outside auditor, underwriters, and legal counsel—to function as reputational intermediaries."[305] The idea is that, because the viability of their own business depends on their reputation, these reputational intermediaries ensure their clients do not defraud the market, intentionally or otherwise.[306] Such reputational intermediaries are referred to as "gatekeepers" because they act as a check on fraud in capital markets and are considered an entrenched element of corporate governance.[307]

Public blockchain protocols do not possess a strong tradition of using auditors, whether of finances or of code.[308] Although some blockchain protocol foundations retain attorneys, after admonitions from various SEC commissioners, few lawyers will offer an opinion letter on any aspect of a blockchain enterprise.[309] Instead, the reputation of a blockchain protocol

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301. *See* de Fontenay, *supra* note 231, at 136.

302. *See generally* Stephen M. Bainbridge, *Corporate Lawyers as Gatekeepers*, 8 UCLA J. SCHOLARLY PERSP. 5 (2012).

303. *Id.*

304. *Id.*

305. BAINBRIDGE, *supra* note 192, at 179.

306. *See id.*

307. John C. Coffee, Jr., *Gatekeeper Failure and Reform: The Challenge of Fashioning Relevant Reforms*, 84 B.U. L. REV. 301, 309 (2004) (defining a gatekeeper as "a reputational intermediary who provides verification or certification services to investors"); John C. Coffee, Jr., *Understanding Enron: "It's About the Gatekeepers, Stupid,"* 57 BUS. LAW. 1403, 1405 (2002) (characterizing gatekeepers in the capital markets context as reputational intermediaries); Ronald J. Gilson & Reinier H. Kraakman, *The Mechanisms of Market Efficiency*, 70 VA. L. REV. 549, 618 (1984).

308. In fact, even when code allegedly had been audited, the audit proved to be relatively useless. In the case of the DAO, for example, creator Christoph Jentzsch wrote: "We believe more security audits or more tests would have made no difference. The main problem was that reviewers did not know what to look for." Christoph Jentzsch, *The History of the DAO and Lessons Learned*, MEDIUM: SLOCK.IT BLOG (Aug. 24, 2016), https://blog.slock.it/the-history-of-the-dao-and-lessons-learned-d06740f8cfa5 [https://perma.cc/FN2A-M2BB].

309. Jay Clayton, Chairman, U.S. Sec. & Exch. Comm'n, Opening Remarks at the Securities Regulation Institute in Washington, D.C. (Jan. 22, 2018), https://www.sec.gov/news/speech/speech-clayton-012218 [https://perma.cc/GBL9-N4LM] ("Our securities laws—and 80 plus years of practice—assume that securities lawyers, accountants, underwriters, and dealers will act responsibly. . . . Legal advice (or in the cases I will cite, the lack thereof) surrounding ICOs helps illustrate this point. . . . First, and most disturbing to me, there are ICOs where the lawyers involved appear to be, on the one hand, assisting promoters in structuring offerings of products that have many of the key features of a securities offering,

often correlates to the reputations of its core development team, its founders, and, occasionally, an organizing foundation that stands behind the protocol.[310] Such individuals and entities act as gatekeepers for public blockchain protocols because they have access to information that the general market of protocol participants does not have and they act as reputational intermediaries for the protocols. Members of the core developer teams, for example, often work on protocol code without promise of specific remuneration.[311] Instead, the reputational boost obtained by acting as a core developer leads to other opportunities for economic gain.[312] Further, to gain entrance to the core development team requires acceptance by the community as a reputable expert in the protocol being managed.[313] In other words, core developers exist in a loop of reputational intermediaries—acting as a reputational intermediary for the protocol while also allowing their own reputation to rise or fall with the integrity of the protocol. Thus, if a core developer becomes aware of misconduct at the protocol level, the core developer is properly incentivized to expose it in order to preserve his or her reputation and future economic prospects. This loosely resembles the reputational intermediary role played by lawyers and auditors in the corporate governance space.

Like core developers, a founder's reputation will rise or fall with the success of the public blockchain protocol he or she created. Although a founder occasionally has special weight in a blockchain community, the cost of that increased influence is an increased reputational hit for any misuse of influence. As such, a founder remains incentivized to report and address misconduct in much the same way as the core developers. In fact, viewing blockchain governance through a corporate governance lens helps explain the Ethereum community's choice to hard fork the Ethereum protocol after the DAO hack.[314] The DAO hack reflected poorly on the reputation of the

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but call it an 'ICO,' which sounds pretty close to an 'IPO.' On the other hand, those lawyers claim the products are not securities, and the promoters proceed without compliance with the securities laws, which deprives investors of the substantive and procedural investor protection requirements of our securities laws.").

310. This is true in any open-source system. *See* Benkler, *supra* note 2, at 387–88 (discussing the importance of quality in Wikipedia's ethos).

311. *Id.* at 423–36.

312. *Id.* at 424–25 ("[T]here is a variety of indirect appropriation mechanisms for those who engage in free software development. These range from the amorphous category of reputation gains to much more mundane benefits, such as consulting contracts, customization services, and increases in human capital that are paid for by employers who can use the skills gained from participation in free software development in proprietary projects.").

313. *See, e.g.*, *Python Developer's Guide*, PYTHON, https://devguide.python.org/coredev/ [https://perma.cc/VXU9-C9JR] (last visited Mar. 17, 2020) ("When you have consistently contributed patches which meet quality standards without requiring extensive rewrites prior to being committed, you may qualify for commit privileges and become a core developer of Python.").

314. *See generally* Michael del Castillo, *The Hard Fork: What's About to Happen to Ethereum and the DAO*, COINDESK (July 24, 2016), https://www.coindesk.com/hard-fork-ethereum-dao [https://perma.cc/7U9G-AN6X].

Ethereum protocol and its widely publicized project—the DAO.[315] To protect the reputation of the protocol, its founder—Vitalik Buterin—and the core development team returned the funds affected by the incident to their original owners.[316] The debate surrounding the hard fork and the continued discussions about the relative value of Ethereum and Ethereum Classic[317] reflect different value judgments about which elements of the Ethereum protocol reputation are most important: equity and fairness or immutability.[318]

The effectiveness of a protocol foundation as a reputational intermediary seems somewhat more attenuated. However, some literature on corporate gatekeepers views any entity with increased access to information as being in a position to intervene when a corporation undertakes bad conduct as a potential gatekeeper.[319] In that sense, a protocol foundation like the Ethereum Foundation, the Bitcoin Foundation, or the Chamber of Digital Commerce might still be considered a gatekeeper. The reduced incentive to expose bad conduct in this context (and actual failure to do so during the last several decades) led to an extensive discussion in the literature as to whether, how, and to what extent to hold gatekeepers accountable.[320] A similar investigation into the possibilities of holding the actors in blockchain governance accountable for governance failures, even if blockchain communities adopt the type of governance contracts proposed here, is beyond the scope of this Article. Such questions, however, remain a rich area for further research.

CONCLUSION

Blockchain technology was born out of a Cypherpunk vision for regulation without sacrificing privacy. This vision feeds a call by some in the blockchain technology ecosystem to view computer code as the only law

315. Michael del Castillo, *Ethereum Executes Blockchain Hard Fork to Return DAO Funds*, COINDESK (July 20, 2016), https://www.coindesk.com/ethereum-executes-blockchain-hard-fork-return-dao-investor-funds [https://perma.cc/SG6U-J3YU].

316. *Id.*

317. *See* Ali Raza, *ETC vs. ETH: Story of Ethereum and Ethereum Classic*, GLOBAL COIN REP. (Oct. 10, 2018), https://globalcoinreport.com/etc-vs-eth-ethereum-ethereum-classic/ [https://perma.cc/JXQ9-S8UJ].

318. *See id.*

319. Kraakman, *supra* note 231, at 54; *see also* de Fontenay, *supra* note 231, at 136 ("The precise definition of a gatekeeper is somewhat elusive, however, as the gatekeeper literature has evolved in two directions. The first, associated with Reinier Kraakman, defines a gatekeeper as any party from whom a company needs a good or service, and who can prevent the company's misconduct simply by refusing to provide it.").

320. *See, e.g.*, Arthur B. Laby, *Differentiating Gatekeepers*, 1 BROOK. J. CORP. FIN. & COM. L. 119, 119–20 (2006) ("While [the reputational intermediary] model has merits, it fails to distinguish among gatekeepers, who are likely to respond differently to incentives. It also fails to appreciate differences in the character of a gatekeeper's relationship with a primary violator and to consider whether such differences bear upon gatekeeper behavior."); Assaf Hamdani, *Gatekeeper Liability*, 77 S. CAL. L. REV. 53, 62–63 (2003) (proposing a three-part mechanism for gatekeeper liability); Frank Partnoy, *Barbarians at the Gatekeepers?: A Proposal for a Modified Strict Liability Regime*, 79 WASH. U. L.Q. 491, 492 (2001) (proposing a regime of strict gatekeeper liability for securities fraud).

applicable to blockchain protocols, transactions conducted on the protocols, and DAOs.[321] In Professor Lawrence Lessig's conception that "code is law," the code acted, not as law enacted by governments and imposed by force of national sovereignty but as so-called soft law.[322] Code in cyberspace "sets the terms on which life in cyberspace is experienced."[323] That code, Lessig warned, is malleable and, as it changes "the character of cyberspace will change as well."[324] The same is true for blockchain protocols. The code of certain protocols, such as the Bitcoin blockchain and Ethereum, currently embody their Cypherpunk cultural origins, placing a premium on privacy and governance mechanisms that preserve privacy. But that code can change. In fact, laws enacted and enforced by governments may act as the stimuli for such change.[325] Indeed, such stimuli, for better or worse, are already in play, with coders ceasing work for fear of legal repercussions.[326] Adopting a contract-based governance system in which the rules and expectations are clearly defined empowers blockchain protocol communities to preserve as much of their cultures and visions as possible. Adopting these contracts also requires blockchain communities to engage in open, active, and thoughtful conversation about their collective culture and vision. Further, basing blockchain governance structures in contracts that loosely resemble corporate governance structures allows such communities to tap into centuries of scholarship and experimentation in a functionally equivalent governance arena.

Somewhat surprisingly, then, the biggest cultural impact of (un)corporate crypto-governance may be on the culture of traditional corporations. Indeed, one significant lesson of a corporate governance model for off-chain governance may be a sharpened recognition that "code as law" is a subsystem of regulatory norms within the greater legal system. Viewed through systems analysis, the result is a two-way recognition of the interconnected roles of code and law in limiting behavior within the blockchain ecosystem. In other

321. This idea also has deep roots in the debate about the nature of cyberspace and the law applicable there. *See generally* Viktor Mayer-Schönberger, *The Shape of Governance: Analyzing the World of Internet Regulation*, 43 VA. J. INT'L L. 605 (2003). For a parallel argument for blockchain protocols, see generally Aaron Wright & Primavera De Filippi, Decentralized Blockchain Technology and the Rise of Lex Cryptographia (Mar. 12, 2015) (unpublished manuscript), http://ssrn.com/abstract=2580664 [https://perma.cc/K3B2-SZU9].

322. Lawrence Lessig, *Code Is Law: On Liberty in Cyberspace*, HARV. MAG. (Jan. 1, 2000), http://harvardmagazine.com/2000/01/code-is-law-html [https://perma.cc/UQW4-BHLW] [hereinafter Lessig, *Code Is Law*]; *see also* Lawrence Lessig, Commentary, *The Law of the Horse: What Cyberlaw Might Teach*, 113 HARV. L. REV. 501, 549 (1999) [hereinafter Lessig, *The Law of the Horse*] ("[M]ore than law alone enables legal values, and law alone cannot guarantee them. If our objective is a world constituted by these values, then it is as much these other regulators—code, but also norms and the market—that must be addressed.").

323. Lessig, *Code Is Law*, *supra* note 322.

324. *Id.*

325. For example, BIP 75 sought to change the Bitcoin blockchain to enable compliance with anti–money laundering laws overseen by the U.S. Financial Crimes Enforcement Network. Kyle Torpey, *Does BIP 75 Really Threaten Bitcoin's Fungibility?*, BITCOIN MAG. (June 30, 2016), https://bitcoinmagazine.com/articles/does-bip-really-threaten-bitcoin-s-fungibility-1467302909 [https://perma.cc/DT3D-QE3U].

326. *See* O'Leary, *supra* note 23.

words, the code informs the law and its application to a blockchain ecosystem. Meanwhile, law informs behavior and activities undertaken through the code. The result is that the intersection of code and law can impact our understanding of how to apply the law in more traditional scenarios as well. For example, engaging in an open and transparent discussion about the appropriate level and nature of fiduciary duties in the blockchain governance context reveals the trade-offs inherent in every imposition of corporate fiduciary duties: whether to emphasize a director-centric or shareholder-centric model of the corporation. Such acknowledgment may lead to more careful consideration of the trade-offs and how to balance them with other elements of corporate governance or corporate legal doctrine. Perhaps, then, code as law not only represents "soft law" regulation of user behavior in a particular cyberspace but also impacts regulation of functionally equivalent traditional architectures outside cyberspace.